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ISSUE 303 • APRIL 2015

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- ✔ Intel's best-ever integrated graphics benchmarked
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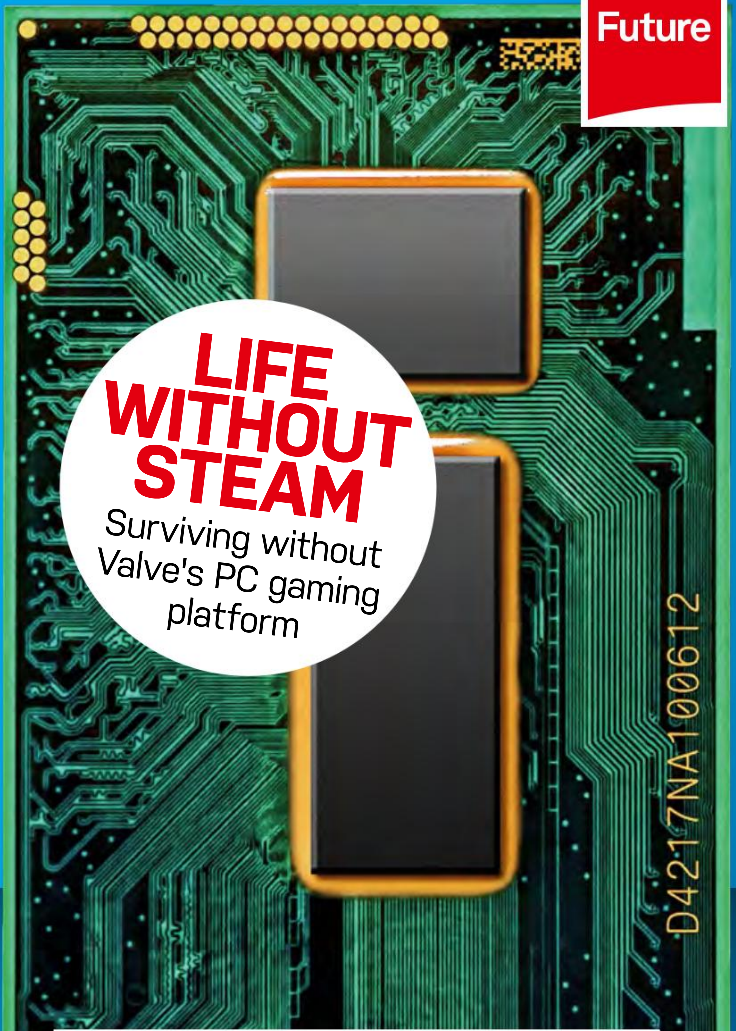

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Jeremy Laird,
Acting editor

IS BROADWELL A BLIP OR IS MOORE'S LAW BACK ON TRACK?

I AM NOT, you may have spotted, Alan. He's away for an issue doing fatherly things. That gives me a one-time-only opportunity at the helm. As luck would have it, I've been airdropped in for what turns out to be a particularly intriguing issue of the good ship *PC Format*.

For starters, we've Intel's new Broadwell family of CPUs delivering excitement and bafflement in equal measure. Excitement because those 14nm transistors get Moore's Law back on track and take another step towards putting proper desktop PC processing into almost any package, regardless of proportions. It also ups Intel's integrated graphics ante. Always welcome.

The bafflement bit is on account of Broadwell's proximity to what comes next from Intel – Skylake. The problem is primarily due to Broadwell's late arrival. It will generate unprecedented oddness if, as we expect, Intel ends up charging more money for what will by then be older Broadwell CPUs on the inferior 9 Series chipset, compared with the latest and greatest Skylake chipset and its fancy new 100 Series platform with added PCI Express goodness. To get your head around it, turn to page 54.

Bearded gaming sage and desiccated cynic par excellence Dan Griliopoulos, meanwhile, looks at what life would be like without Steam. Frustrating and fantastic, albeit more often the latter, Steam has radically changed the way we buy games, the way we play games and the way we interact with other gamers. It's also shaken up game development.

But all empires eventually crumble. So it cannot, it will not, last forever. Which begs the question of what gaming in the future will look like, both for gamers and developers, in the inevitable post-Steam era. For answers, hop on over to page 64.

And finally, mice. Input devices aren't normally my bag, but having read Ian Evenden's gaming rodent test, I laughed, I cried, I decided to buy a laser mouse. Okay, I didn't cry. But I learned a thing or three. You might, too, on page eight.

Jeremy.

Jeremy Laird, Acting editor

↘ submit your questions to: alan.dexter@futurenet.com

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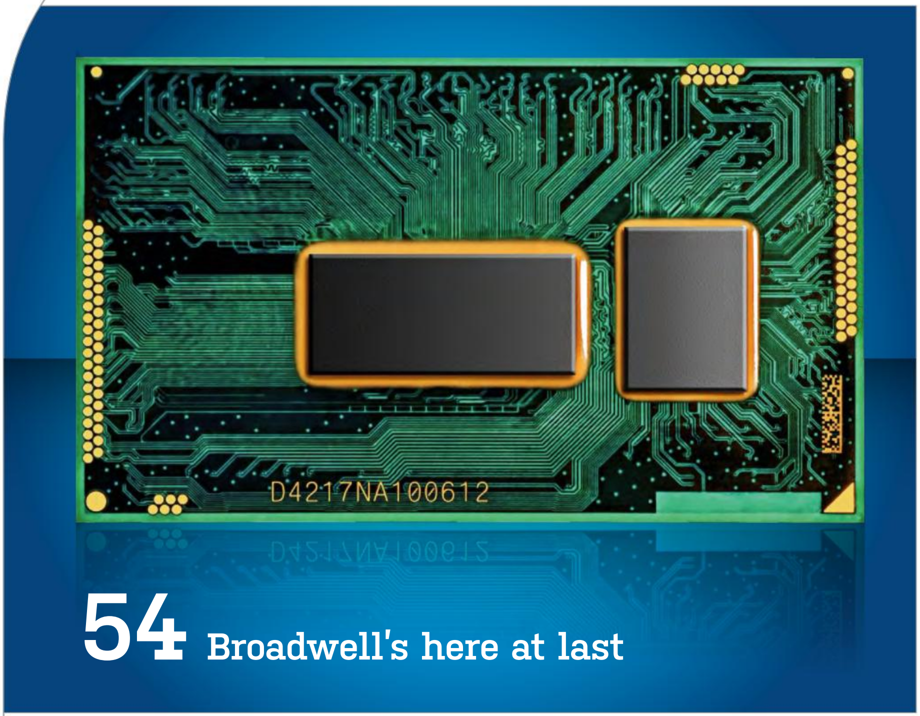

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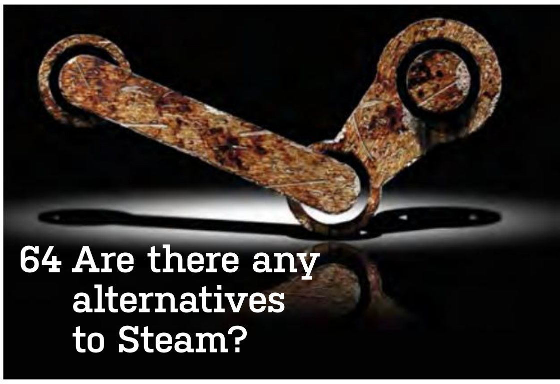

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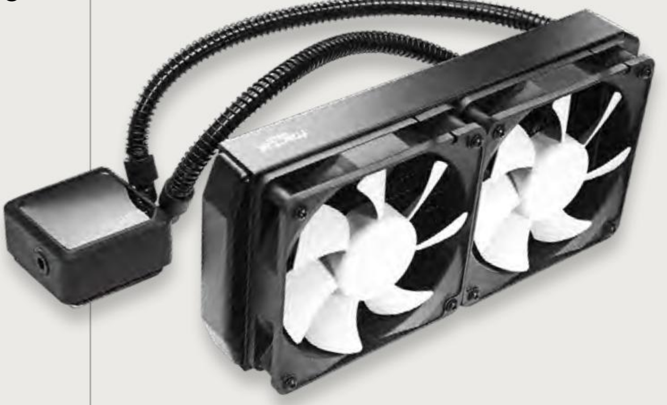

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Power-up your gaming prowess by finding the perfect mouse **PAGE 08**

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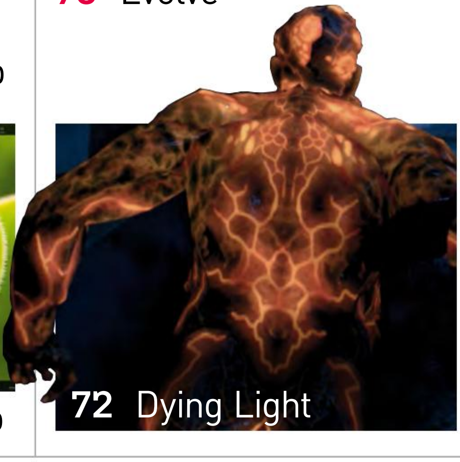

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THE GREAT MOUSE COLLECTIVE

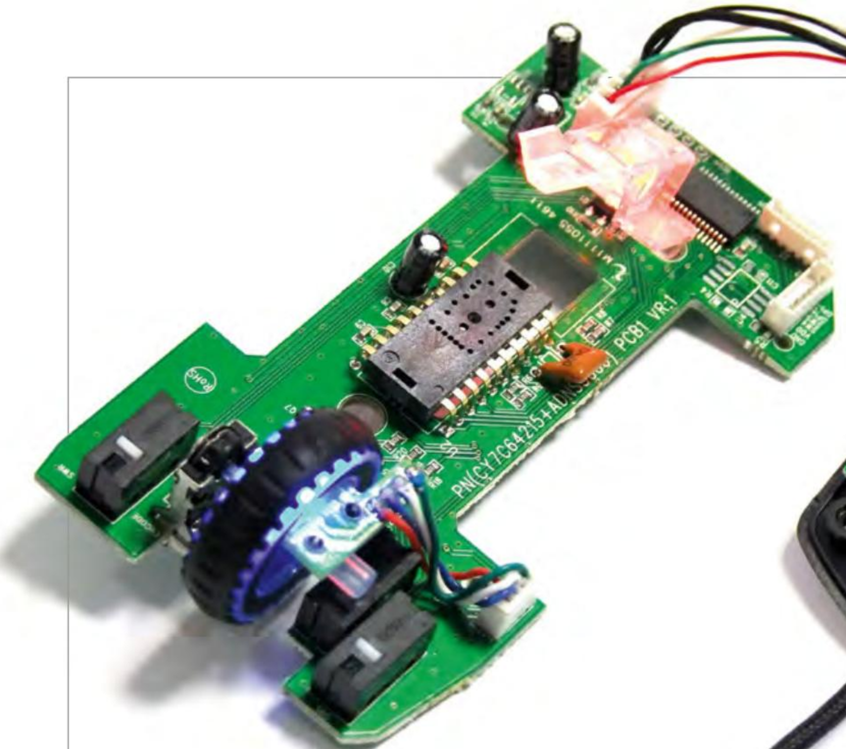
A whole heap of gaming rodents, dissected, investigated and served up for your pleasure

THE HUMBLE COMPUTER MOUSE – sleekit, cow'rin, tim'rous beastie of the desktop – has a reputation for being dull. It's got a couple of buttons, a wheel, it might be wireless but if it is then sometimes it doesn't work. It's perfectly happy with a USB 2.0 port, maybe one on a keyboard hub that doesn't give out much power. In conclusion: mice are boring, any old one will do as long as it moves the pointer. Now go and worry about whether you want blue case lights or green.

But *PC Format* says no! Mice are exciting! They'll put a panic in thy breastie and leave thy wee housie in ruin too if you're not careful. They'll rampage across your desk and have you issuing commands faster than you ever previously could. Before we descend completely into the kind of marketing nonsense you might get from a peripheral manufacturer, let's get on with the testing...

This is a supertest of gaming mice. They're not out to change the world, but they are hoping to make you slightly better at games by lowering your response times, increasing the amount of screen real estate you can cover with a single flick of the wrist, and upping your accuracy.

All the mice here have adjustable sensitivity, most of them have programmable buttons and, often, absolutely pointless coloured lighting systems. Many of them have sniper buttons, which lower the sensitivity while they're held down – the idea being that while drawing a bead on an enemy's head with a sniper rifle, you want to be wobbling



That little chip in the middle is the important bit – the laser sensor. The red bit is the laser...

The basic, green PCB and little black Omron switches look rather flimsy under the mouse skin.

around as little as possible. It's like holding your breath, except you don't die.

Another thing they have in common is multiple buttons that can have commands assigned to them with PC software. Some have memory onboard to store multiple profiles, too. Once a simple rolling ball enclosure that moved a pointer, mice are now being packed with technology. A few even sport CPUs of their own.

There are two strains of mouse user. There are the palmers, who lay their hands flat, their fingers draped languorously over the buttons like Jessica Rabbit sunbathing on *Celebrity Big Brother*. And the claw-grippers, who approach their mouse like an *Alien* face-hugger.

GETTING HANDS-ON

Palmers don't use the tips of their fingers but rather the pads, sacrificing a small amount of responsiveness and accuracy for long-term comfort and endurance. Claw-grippers can build up strain in the fingers if their mouse isn't the right shape for their hand, but there's no one faster to get the pointer across the screen or the finger on the right button.

Palmers often prefer a larger mouse with plenty of contact between the back of the body and their sweaty hand-slab, while a mouse designed for a claw-gripper will be smaller and lower to accommodate the fingertips. The claw-gripper's palm may never even touch the back of the mouse, unless they're using it to slog away in Excel for an afternoon. After all, even the greatest *Arma* sniper gotta get paid.

Likewise, there are two major types of sensor in mice these days – the laser and the optical. Not one mouse in this test has the old-fashioned rolling ball underneath. In fact, we can't even remember when we last saw one. The design had several in-built flaws, not least its tendency to pick up dirt from the surface it was used on. This dirt was collected by the ball but almost always passed on to the rollers that detected the ball's movement, lowering their sensitivity to a point that the pointer didn't move at all, meaning the ball had to be removed so the rollers could be cleaned. This often meant unbending paperclips or using some other inappropriate sharp object, which left scratches that could collect dirt... and round and round we went. Much like a ball in a mouse.

Playing any sort of fast-paced game with a mechanical mouse – at least as far back as the original *Quake* – was an unsatisfying experience. Games have changed as well, of course, becoming more twitch-based and with an increase in the real-time elements that necessitate fast pointer movements. We wouldn't want to play a modern FPS with a rolling ball under our hand, but remember trying to play *Doom* and *Wing Commander* with one. Games back then weren't built with the kind of mouse controls we have today in mind.

Do you want a heavy mouse or a lightweight, flyaway rodent?

OPTICAL EXPRESS

Thanks to the optical mouse, we don't have to. Through the use of a camera-like device, known as an electro-optical sensor, they keep track of the surface they're being moved across without having to be in physical contact with it. The base of the mouse usually is, however, and manufacturers go to great pains to make sure their mice have 'feet' that will glide across a desk smoothly.

The optical mouse dates back to 1980, when MIT and Xerox independently came up with designs. The MIT mouse would perhaps be familiar today, with an infrared LED as a light source, but needed grid lines drawn on to a mouse pad in special ink to work. No slamming it straight against the desk surface there. Xerox's invention has its modern counterpart in the Fusion Engine used in some Logitech mice, with its melding of a light sensor and motion detection. Xerox too used a special pad, this time with coloured dots on it.

It took until 1999 for optical mice to hit the mainstream, with Microsoft's use of

HP tech in the Intellimouse Explorer. The Intellimouse brand had been around for a couple of years as a mechanical mouse, and we've got MS to thank for introducing other features we take as standard today, such as extra buttons and scroll wheels.

Since then, improved manufacturing processes have made it possible to fit more and more processing power into smaller and smaller spaces. Some of the mice on test here sport discrete 32-bit ARM processors, and still find room for weighting systems and pockets of fresh air.

IN YOUR SIGHTS

Laser mice are a subspecies of optical mice that sound a lot more exciting than they are. Something has to illuminate the surface under a mouse for the surface tracking to work, and in most optical mice it's an LED just like in your Christmas lights. They're commonly red, as these were the first LEDs developed and therefore the cheapest, but any colour will work. Laser mice build on this by using an infrared laser LED, broadly similar to the one in your DVD drive. Sadly, as much as we may have fantasised about it, you're not going to be able to shoot your boss in the neck from across the office, causing a self-cauterising wound and doing irreparable nerve damage, with a laser mouse. Some people think about this too much. [Yes, it seems they do – Ed.]

> “Mice are now packed with technology. A few even sport CPUs of their own.”

The laser illumination increases the resolution of the tracking sensor, leading to increased accuracy of movement translated to the pointer. In the real world, you're unlikely to notice a difference between an optical and laser mouse unless you live somewhere entirely made of glass (in which case we have questions for you about the plumbing), as laser mice can track transparent surfaces an optical mouse would give up on.

It's those real-world needs that should be foremost in your mind when choosing a gaming mouse. Do you need 90 programmable functions? Does the weight balance in your current mouse drive you so wild that you pace the floors at night wishing you could alter it? Would the ability to map commands to mouse buttons make you a better gamer, or can you just use the keyboard commands? After all, you've still got to remember them, wherever they are.

You can spend a lot on a mouse. But as we'll see, if you don't need the advanced features, you can still get a heck of a lot of rodent for a bargain price. –IAN EVENDEN

With Microsoft's Kinect and Intel's RealSense, gesture could be the future.

The Future of War?

HOW WILL YOU BE CONTROLLING YOUR GAMING PC IN THE FUTURE? TOUCH, GESTURE, THOUGHT CONTROL?

Despite what some companies might have us believe, the mouse does not seem to be threatened by the flood of touchscreen devices. Our PCs are not tablets or phones, and while a touchscreen laptop is fun for five minutes, its usefulness outside Windows 8's interface-formerly-known-as-Metro is questionable.

And that goes doubly for games. Anyone who's ever tried to play games using a laptop's trackpad will have found out very quickly that it's fine for a quick blast of something turn-based, but its lack of space, responsiveness and sensitivity soon lead to frustration in anything that requires actual reflexes.

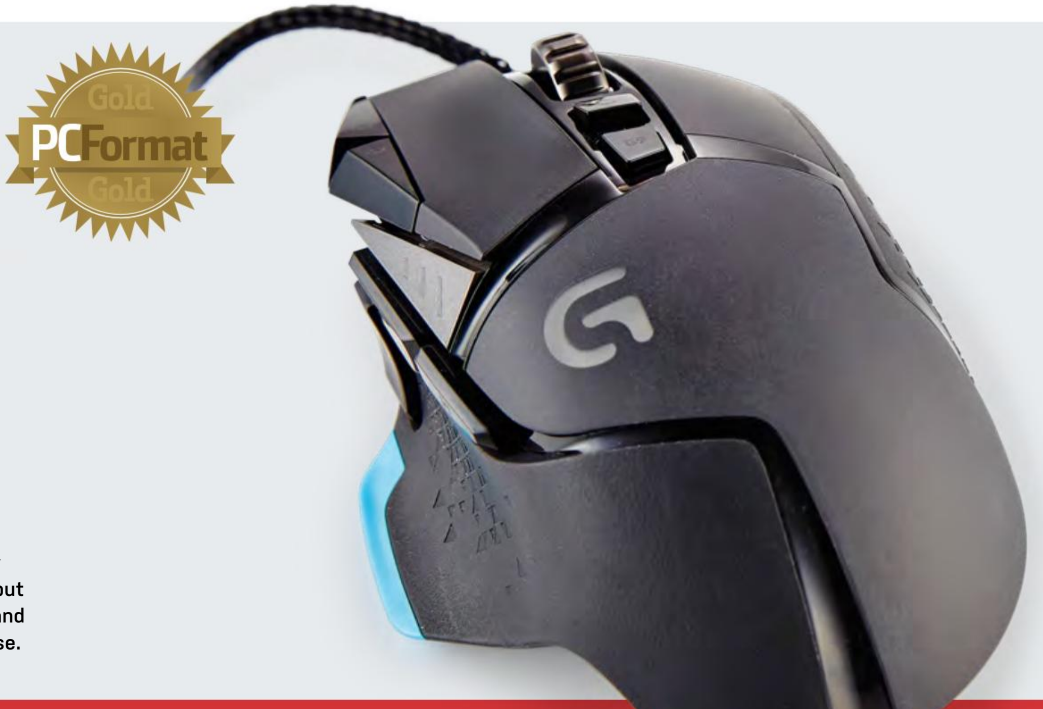
The future could be very different, however, as motion detection is on the rise. There's the Leap Controller, a fancy webcam that tracks your finger movements; Microsoft's Kinect Xbox controller, which tracks you dancing round your living room; and the Haptix, a project funded through Kickstarter that looks very much like *Wall-E*'s webcam and turns any flat surface into a 3D multitouch controller.

Haptix looks a bit like you're controlling your PC with a large invisible iPad, and a startup called DexType is using the technology to create invisible keyboards too. This sounds like a recipe for disaster, but relies on a form of typing that condenses the alphabet down to 10 letters and uses finger combinations to make the rest – it only matters which fingers are pressed down, not where they're pressed.

So now we've killed off both the mouse and the keyboard, where does that leave us? Well, for the time being, things are probably not going to radically change. The superiority of mouse and keyboard controls has long been an argument against letting console and PC gamers play together online, but with the rise of VR (and better controllers), PC players are more often using console-like control schemes.

So the future could bring a levelled playing field, even if it does mean the death of the mouse as we know it today.

Sixense's Stem system could be the perfect VR controller system.



It may look like an ugly lump of black plastic, but this is a finely tuned, and tuneable, gaming mouse.

LOGITECH G502 PROTEUS CORE

Is that the best you've got, Logitech? Well, yes...

LEAVING ASIDE THE ABSURD NAME, which sounds like something from console shooter *Destiny*, that PC gamers would know nothing about, the G502 is an excellent mouse. Unlike the Sharkoon Fireglider that follows, this should come as no surprise. It's Logitech's current top-of-the-range gaming mouse and has had bells, whistles and attention lavished on it.

The one thing its smart design is missing is an extendable body; for those of us with bear paws it comes up a little short. There's a prescribed place for your thumb on the left, on a ledge just behind the sniper key and below two of the programmable buttons, and any movement from this area renders them unpressable. It's designed with the claw-gripper in mind, but is perfectly usable by a palmer as long as you're not expecting remarkable length.

In use, and as long as you keep your thumb in the right place, the G502 reflects its range-topping status. The bog-standard plastic finish is enlivened with a little grip-enhancing texturing. The mouse is held above the desktop on six oddly shaped feet, and in our tests slid cleanly across a variety of surfaces – which also gave us a chance to try out the Logitech Gaming Software, that claims to calibrate your mouse so every surface glides past like velvet smeared with Vaseline. It seemed to cope well with our desk, last cleaned in about 2008.

Button placement is excellent, though with the proviso about your thumb once again. If you're a massive clumsy idiot, there's a small chance you could knock the buttons near the main left clicker when the red mists of gun-fury take over, but *PC Format*'s official massive clumsy idiot seemed to have no problems when we taped the mouse to his hand and explained patiently what we wanted him to do.

THE WHEEL DEAL

The buttons are a trifle disappointing in terms of travel though – we much prefer to feel the button go down and depress the switch rather than relying on screen feedback, and the G502 doesn't manage more than an anaemic 'snick' from most of its switches. There is one glorious exception to this: the button that switches the wheel between free-spinning and sectioned resistance modes is simply wonderful. So satisfying it elicited a cry of joy that caused heads to turn, even in an office used to such ejaculations. It led to us scrolling through our Steam library hunting for a game that would need the switch to be pressed frequently.

Ridiculous behaviour? Perhaps, but a good wheel is something that endears one to a mouse. And the G502's has a trick up its sleeve, tilting left and right for scrolling that's especially useful for moving the camera around an RTS battlefield (or reading a web page). As a result of all this wheel-based fun it can feel a little like having your finger suspended in the interior of a Dalek, all switches and probes and electronic sensors.

The mouse's headline feature is an insanely high sensitivity of 12,000dpi. Just because you can do this doesn't mean you should, and it proves far too sensitive for any use. Maybe a *Starcraft II* savant with a 4K screen might get some use out of it, but for the likes of us it becomes a game of spot-the-pointer all too quickly.

This is a mouse that deserves its place at the top of Logitech's range, and while not exactly a budget model, we'd take it over more expensive rivals.

SPECIFICATIONS

Sensor	Optical
Max sensitivity	12,000dpi
Programmable buttons	11

VERDICT 9

Logitech G502 Proteus Core

➕ **LOGI** Lovely to use and a clever Fusion Engine.

➖ **BOGI** You need to keep your hand in the right place.

£45, www.logitech.com

The what? By who?
For how much?
Yeah, we'd never
heard of it either.

SHARKOON FIREGLIDER

Super-cheap gaming mouse turns out golden

FIREGLIDER. FIRE. GLIDER. That's a good name, isn't it? Two things a mouse should do, firing and gliding, together at last. You can find this mouse for around £15 online, and despite being decked out with the kind of art more usually seen tattooed on the biceps of the guy at the gym who doesn't wipe down the machines or put the weights away properly, this was – much to our surprise – a comfortable and satisfying mouse to use.

The length of the body isn't adjustable, so maybe it comes down to having the kind of hands more often seen gripping cage bars at the zoo, but this long, high-set mouse fits perfectly in our palm. With a shape much like that of Marilyn Monroe during her time playing in the front row for Wasps, the third finger slides perfectly along the shoulder created by the right-hand button to grip the body by its waist.

On the left, a soft rubber pad is ribbed for your pleasure, looking not unlike the gills of a fungus, and provides somewhere for your thumb to sit, the two side buttons positioned just above it. One of these buttons is textured, the other smooth, adding an extra layer of tactility to differentiate between them when groping blindly while firing and gliding.

The main buttons are well designed as well, smooth but broad and with raised edges to keep your fingers in place. The additional button near the wheel has a textured top, and pressing it takes an easy hop of the finger.

The textured surfaces make such a contrast because the rest of the mouse's body is so smooth. Its matte black plastic offers no grippy coating and it's perfectly possible to slide your fingers off any of its body surfaces. This doesn't happen during use, the rampant rubber on the left and the size and shape of the body keeping it secure. Oddly, the base plate looks as if it does have a texture, right where you wouldn't want it, but this is raised slightly from the desktop and makes no difference to its gliding.

SOME LIKE IT HOT

The texturing seems to be there to facilitate the opening of the weights door. Seven bits of metal are arranged in something like a revolver's cylinder, and can be added and removed to adjust mass and balance. There really isn't all that much difference between having them all in or all out, however, and the Fireglider could have done away with this feature and knocked another 50p off the price. But marketing boxes need to be ticked. And while this isn't an ambidextrous mouse, the 10 per cent of us out there with the higher risk of psychiatric disorders could use it, at a pinch, without too much trouble.

The Fireglider is meant to be a budget model, but punches enough above its weight to have almost ended up at the top of our supertest. Picking between this and the Logitech G502 is like choosing which Chippendale you'd most like to oil up: it's ultimately down to the shape of your hands and how you like to grip. The Fireglider, with its length and height, is a palmer's mouse, while the G502 is ambi-grippable, but repays the claw-gripper more. Then there's price, of course, with the Logitech costing three times as much.

Buying a cheap mouse is always going to contain a slight element of risk. You never know what corners have been cut in terms of switches or sensors, but when a cheap mouse is as nicely designed as this, even a short time spent firing and gliding together is worth the money.

SPECIFICATIONS

Sensor	Laser
Max sensitivity	3,600dpi
Programmable buttons	Six

VERDICT
8

Sharkoon Fireglider

⊞ **FIRE** £15. £15. £15. £15. £15.

⊟ **DIRE** Buy cheap, buy twice?

£15, www.sharkoon.com

ELEMENT IRIDIUM 280

Repeat after us: basic design is important

THERE ARE SOME THINGS that feel like they're meant to be in your hand. The brass handle of a local pub, worn smooth by generations of feckless layabouts. The leather-bound grip of a favoured dagger. Certain parts of someone else's lover. And then there is the Element Iridium.

It ticks all the boxes. The body length can be adjusted. There are programmable buttons. You can fiddle with the light it emits. There's a weighting system. The Iridium wants you to like it so much, but all its bells and whistles are attached to a poorly designed body with a strange hump protruding from the right, forcing you to readjust your grip. It's a baffling inclusion, only becoming close to comfortable if you put your middle and ring fingers either side of it, leaving your index finger to work all the buttons. A claw grip with the hump between ring and little fingertips seems the best compromise.

A large bolt that screws into the back of the body controls the mouse's length. Unscrewing it extends the rear panel like an aftermarket spoiler on the back of a Vauxhall Nova, two springs making sure both sides extend evenly. The weighting system is nuts – literally. A small cartridge holds four nuts that the extension bolt screws through, but both they and the bolt are so slight that they make no difference to the feel of the mouse whatsoever.

As for the buttons, well, they work and don't feel like they're in imminent danger of falling off. Palmers may find their hand is too far forward on the body to easily press the side or extra top buttons.

Still, it's not all bad. More mice should have a button marked 'attack'. You know where you are with such straightforward labelling. That's it though. We used this mouse for a morning before getting utterly fed up with it.

SPECIFICATIONS

Sensor	Laser
Max sensitivity	8,200dpi
Programmable buttons	Eight

VERDICT 3

Element Iridium 280

⊞ **ELEMENT** Works; succeeds in not falling apart.

⊟ **REDOLENT** Everything else about it.

£23, www.elementgaming.com

MAD CATZ R.A.T TE

Lightness is a virtue, but not the only one

THE R.A.T'S SHAPE is strongly reminiscent of the hand of Lex, protagonist of Origin's 1995 game *Bioforge*, that's so nicely picked out in green in the box art. (For those of you somehow not familiar with a 20-year-old DOS game that didn't sell spectacularly well, it'll run in Dosbox and is an interesting document of the exact point that 3D graphics came faltering and glitching over the hill, with quite a lot in common with the original *Resident Evil* and… well, you'll see, we better get back to the mouse.)

The other thing it has in common with Lex is that its casing seems to be coming apart and large parts of its innards are visible. It's all very impressive to look at, but does it do anything when you actually use the thing?

The body of the mouse is quite broad – we're not sure we'd want to find anything broader, although in the Element Iridium 820, we did – and sits reasonably low and flat. You can alter its length by pressing a spring-loaded switch at the back. Its shape is an interesting experiment in how far you can warp the form of a mouse and still have it remain recognisably a mouse. There's a lot of empty space inside its body, just as there is inside the head of the person who decided to make it entirely from plastic.

It's too light, and feels flimsy. For all of its nice touches, such as the shelf that extends from the left to cradle your thumb and keep it at the right height for the nearby buttons, it's the only mouse we've come across that's actually crying out for one of those weighting systems that are so popular with the young people these days. A few pellets of depleted uranium inserted where the sun cannot possibly shine might give it a bit more presence under your hand.

The manufacturer actually makes a point of its lightness in its sales pitch, but pick up a R.A.T 7 after a session with the TE and you'll be left with no doubt about which is the higher quality product.

SPECIFICATIONS

Sensor	Laser
Max sensitivity	8,200dpi
Programmable buttons	Nine

VERDICT 5

Mad Catz R.A.T TE

⊞ **RATTY** Distinctive look; fast; decent accuracy.

⊟ **TATTY** So light as to be insubstantial.

£50, www.madcatz.com

COOLERMASTER REAPER

Proof, if needed, that metal will never die

AN ALUMINIUM GAMING MOUSE! That's what the box says. How wonderful! It'll come out of the packet all shiny and cool and will need gloves to handle in winter and... oh. It's not an aluminium gaming mouse. It's a plastic gaming mouse made from the same old soft-touch matte-black stuff, with a shiny aluminium panel on the back where it meets your palm.

Under your hand, the aluminium panel feels cool at first but soon warms up to ambient temperature. Sadly there's no active liquid cooling going on inside. Beneath the mouse there's a recessed nut that can be undone to remove and replace the aluminium panel. Replace with what though? It's described as "customisable" by the manufacturer, and maybe that means you can paint it and put it back on, but there are only aluminium replacements available on the CoolerMaster online store. A shame, as we fancied a gold one.

The wheel is metal too, and is a lovely thing to contentedly twiddle with. Your finger will glide over it all graceful at first, but apply a modicum of pressure and the heavy wheel begins to turn most satisfyingly, each notch choonking into place unambiguously. The other switches, unfortunately, are a bit more forgettable. The best of them is the large 'clutch' button at the front of the thumb area – it's nice to feel a great big one occasionally, rather than the tiny and hard-to-find switches that are all over most gaming mice.

The rest of the Reaper's operation is decidedly average too. It's a terrible thing to say of a product that it's merely 'fine', but the Reaper is just that and nothing more. It fulfils all its functions with no great panache or excitement apart from the notable exceptions of a genuinely excellent wheel and a gradually warming cold patch sat on its back.

SPECIFICATIONS

Sensor	Laser
Max sensitivity	8,200dpi
Programmable buttons	Eight

VERDICT
5

CoolerMaster Reaper

+ REAPER Excellent wheel; big switches.

− CREEPER The rest is merely average.

£44, www.coolermaster.com

MAD CATZ R.A.T 7 MMO

The most bonkers mouse on the market

THE RADIATION-GORGED MUTANT of the Mad Catz family sprouts so many things to press and twiddle with that it could probably keep a sensory class full of toddlers entertained all day. We half expected it to start playing the theme tune to *Balamory* any moment. It shares the same basic shape – and therefore the same criticisms – as the Tournament Edition, but the MMO's improved build and weight mark it out as the superior product.

Using the spring-loaded lever to adjust the length is more important with this mouse than perhaps any other we've put to the test this month, as the position of the player's thumb really does matter.

Five buttons and a mini-joystick are positioned around it, and having the opposable digit extended too far can really be disastrous, as a missed button means a missed spell or attack, or even worse, a sickening few seconds spent having to actually look at the mouse itself.

Look at it you will in the first days of ownership. The bright red and black model provided to us for review is a beautiful, striking thing that attracts admiration and comment, whether it's sat on a desk or we're sitting stroking it on the bus.

While normally we're suckers for anything you can adjust with an Allen key – and there's one cleverly tucked away up this mouse's bottom, ready to make adjustments a simple thumbscrew could probably have coped with – the MMO suffers from being too complex.

If you're not going to use its 15 programmable buttons, and memorise the functions you've assigned to each through three modes and a shift key, then it's just overkill. It will ultimately frustrate more often than it will delight.

The Tournament Edition isn't enough. But then the MMO is too much. You'd be better off looking to the bog-standard R.A.T 7 for the Goldilocks zone of this range.

SPECIFICATIONS

Sensor	Laser
Max sensitivity	6,400dpi
Programmable buttons	15 with four modes

VERDICT
8

Mad Catz R.A.T 7 MMO

+ HEAVEN Perfect if you like to fiddle; good build quality.

− HEATHEN Too much if you just want to play.

£77, www.madcatz.com

EVGA TORQ X10 CARBON

Space-age materials don't beat old problems

"REAL CARBON FIBRE SURFACE!" shouts the website. This is going to be the aluminium Reaper again, isn't it? Maybe not.

If it's the sides or the top of the mouse that are made from carbon fibre, we couldn't tell, but any weight-saving gains from using F1 teams' favourite material are lost thanks to the solid metal frame and base lurking underneath. And that's before you start fiddling with the weights, a supply of which are included in the packaging, along with a cute little Torx screwdriver for adjusting the height of the mouse body. It ships in the lowest position, and seems balanced between palming and claw-gripping, but jacking the mouse up to its greatest height makes a drastic difference if you're a palmer.

It's an odd-feeling mouse. The sides look as if they're going to be as smooth as ice, but once you get your fingers on them they're surprisingly grippy. The top surface is pitted and almost warm to the touch… presumably it's some sort of preserved animal flesh. Or it might be the carbon fibre. We'll never know.

It's the only ambidextrous mouse in this supertest, and as such has buttons on both sides of the body. The side switches are a touch on the wobbly side, which is disappointing, and have several millimetres of travel after the switch has clicked. The main switches are Omrons, good for five million clicks, and the wheel that's slung between them is a touch stiff to turn and doesn't click in very positively. Its click is quiet too. Without immediate on-screen feedback there could be a question over whether your press has registered.

Unless you're left-handed, it's hard to recommend this over others we've tested. The carbon fibre is nice, but it feels like you're paying for a pricey material at the expense of other more important features.

SPECIFICATIONS

Sensor	Laser
Max sensitivity	8,200dpi
Programmable buttons	Nine

VERDICT 5

EVGA Torq X10 Carbon

⊞ **CARBON** Good mouse for either hand.

⊟ **CARPET** Why add the carbon fibre? Why?

£63, www.evga.com

CORSAIR VENGEANCE M65 RGB

A showoff that still prioritises functionality

CORSAIR
GAMING

SO FAR IN THIS SUPERTEST, we haven't mentioned customisable lighting systems much. That's been no accident. It's because almost every mouse may have them nowadays, but they add absolutely nothing to the use or performance of the unit, unless you're prone to losing yours in the dark pit beneath your desk that occasionally spews goblins who steal your socks – a distinct possibility thanks to the long cables now being attached to mice as a matter of course.

The other reason is that nothing can live up to the M65 RGB in terms of the customisability or sheer bloody stupidity of its excessive lighting.

For something that spends its life hidden by your hand, out of even your peripheral vision when your eyes are glued to the screen, the only conclusion to draw is that the mouse's 16.8 million colour palette – with roughly seven million more colours than the human eye can distinguish – is for other people to look at. You know, the people who watch you play games but move so quickly they vanish when you turn your head. You know they're there though. You feel them watching you. Just us? Okay.

The mouse's aluminium body keeps it light and rigid, and the shape makes it a good fit for palmers. There's a smooth black coating on the top of the body that's soft to the touch, which gives way to something much rougher at the sides for you to get hold of. The main buttons are responsive, but we found the side buttons a little less satisfying, pressing the wrong one on occasion as they seem to blend into one another.

The best thing about the M65, however, is the wheel. It's broad with a lovely grippy tyre on it, its graduations distinct from one another without making it hard to turn. That wheel caps off an excellent mouse, although we'd like to see a version with no lighting system that's about half the price.

SPECIFICATIONS

Sensor	Laser
Max sensitivity	8,200dpi
Programmable buttons	Eight

VERDICT 8

Corsair Vengeance M65 RGB

⊞ **COLOUR** Great wheel; excellent chassis.

⊟ **SQUALOR** The coloured lightshow is pointlessly adding to the price.

£49, www.corsair.com

DinoPC.com

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- Corsair CS 650W Modular PSU

Microraptor **£1,049**

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- Windows 8.1 (64-bit)
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LOGITECH G402 HYPERION FURY

A mouse for the quick-wristed

THOSE DEMONIC FLESH-MELDING wizards at Logitech have taken it too far this time, transplanting the brain from an old Raspberry Pi (or low-end mobile phone) into a mouse. Freed from the need to constantly check Facebook or stream episodes of *My Little Pony: Friendship is Magic*, the 32-bit ARM core here monitors a gyroscope and accelerometer combo that the manufacturer lovingly refers to as a Fusion Engine.

Sadly, there's no magnetically confined plasma here. What you do get, however, is a claimed tracking speed of 500IPS (inches per second). That's 12.7 metres, or 50 pieces of uncooked spaghetti laid end to end, or 1/11732.3 of Wales, measured at its widest point, in one second. These statistics mean nothing, of course. What's important is that, unless you're going to move your mouse at more than 28.4mph (that's 0.7mph faster than Usain Bolt's 2009 world record-setting speed), it will keep up with you without getting a stitch. It'll predict your movements, too, if the sensor ever loses track of the surface.

Having a right button that extends slightly further than the left means the mouse looks rather like the unholy offspring of Mater, from Disney's *Cars*, and Nosferatu. That's not a mouth we'd want to put our fingers in – there are surprisingly few we would, thinking about it – but the button placement on the G402 is unlikely to cause the loss of too many digits.

Unlike it's bigger brother the G502, there is no absurd sensitivity setting here, topping out at a mere 4,000dpi – high enough for most uses. The body could benefit from being a bit bigger for the palmers out there, and makes use of an awful lot of plastic in its construction, but if you've got the fastest hands in town, this is the mouse for you.

SPECIFICATIONS

Sensor	Optical
Max sensitivity	4,000dpi
Programmable buttons	Eight

VERDICT 8

Logitech G402 Hyperion Fury

➕ **SPEEDY** No other mouse can keep up.

➖ **SEEDY** It's still not as good as the G502.

£35, www.logitech.com

ASUS STRIX CLAW

Beware, small furry mammals

SADLY NOT A RANGE of peripherals inspired by everyone's favourite magic potion-powered basher of the Romans, Strix seems to be a sister brand to Asus's Republic of Gamers line, which has produced some excellent gaming mice in the recent past.

So, Strix. That's a genus of owl, in case you were wondering, and owls are fond of eating mice. In naming a mouse after owls, crafty old Asus is indulging in a bit of linguistic reappropriation to take the power back from the owls. About time, too. Power, as the philosopher Michel Foucault wrote, is not possessed but exercised, "[power] exerts pressure on them, just as they themselves, in their struggle against it, resist the grip it has on them".

The Claw can't be said to resist the grip you have on it exactly, but it doesn't feel great in the hand. The shiny finish would be quite tactile if it didn't feel so thin, but we managed to use it without puncturing the casing. The Omron switches under the main buttons feel like they're good quality, but unfortunately the same can't really be said for the programmable side switches, which make a disappointingly weak click when they're depressed.

It's also perfectly possible to accidentally press the lower of the three with your thumb if you move the mouse to the right in a hurry. Which isn't ideal.

The Claw's cable emerges from something not unlike a Roman galley's ramming prow at the front of the body. The box the mouse emerges from makes a big thing of the cable helping to counteract snags and tangles, and as this prow has a sharp tip, we can only assume it's there to cut the cable of another mouse it's become tangled with, LAN parties being the close contact sports that they are.

The Claw isn't a bad mouse, all in all, but it feels cheap, and there are better options out there for the money.

SPECIFICATIONS

Sensor	Optical
Max sensitivity	5,000dpi
Programmable buttons	Eight

VERDICT 5

Asus Strix Claw

➕ **TAWNY** Good ergonomic shape; effective main buttons.

➖ **SCRAWNY** Feels cheap but isn't.

£47, www.asus.com

STEELSERIES RIVAL

A subtle, even elegant, gaming mouse

"THAT'S A NICE MOUSE," says the snake-hipped art editor from our sister title *MacFormat*, who slinks in and sits at one of our computers while wearing a hat fashioned from a single piece of aluminium in California. He's handling the SteelSeries Rival, and he's right.

It doesn't look much, on the outside. It's certainly the antithesis of anything produced by the Cupertino phone manufacturer, being large and black (though also available in pale-horseman white) and throbbing with orange light. But it's in its restraint and refinement that this mouse shines.

The Rival is a long mouse, one that palmers will probably be more at home with, and would be almost rectangular if it weren't for a sexy little shimmy to the right halfway down its length. This is what passes for ergonomics, and means a left-hander could use the mouse with little difficulty as long as they could deal with the buttons being on the wrong side.

Those side switches are subtle, being flush with the casing and almost invisible until needed. The rear switch is longer than the front one, allowing for a range of hand positions, and takes the same amount of pressure to activate no matter where you press it. None of the buttons have a great deal of travel, even the wheel button, but the switches they rest on are rated for 30 million clicks, so this looks like a mouse engineered to last.

If you've got a 3D printer handy, you can download a template from the SteelSeries website that allows you to make a custom name-plate for the back of the mouse (to replace the default one that says Rival). This way, at the end of the school day when everyone collects their mice from the hooks out in the corridor, you'll always know which is yours.

SPECIFICATIONS

Sensor	Optical
Max sensitivity	6,500dpi
Programmable buttons	Six

VERDICT 6

SteelSeries Rival

+ STEEL Gorgeous, restrained design; built to last.

– SQUEAL Not particularly exciting.

£37, www.steelseries.com

ZALMAN M400

Switching passivity for activity

ZALMAN, THE QUIET PC SPECIALIST famous for its too-nice-to-go-in-the-case Flower range of passive CPU coolers, has made a mouse that will lead to a very noisy PC user. It's certainly one for the claw-grippers, but feels so cheap that the grip is unlikely to last for long.

On the plus side, it's the only mouse in the supertest that we received with a little plastic cover over the end of the USB plug, which is a nice touch. But it just highlights how that kind of attention to detail is lacking elsewhere. If even a bit of that love had been deployed on the rest of the mouse, the M400 would've been greatly improved.

There's its shape, for a start. We don't know if you ever used the, shudder, 'puck' mouse that came with Apple's iMac G3, but it was round and foul and utterly horrid, as if belched from the very bowels of Satan himself. The only way to possibly know which way it was facing was to use the cable as a guide, and it rotated under your hand.

The M400 isn't quite as bad as that mechanical monstrosity, but the roundness of its underside did bring on some queasy 'Nam-like flashbacks. The top is shiny, running a constant risk of finger-slide, while the side buttons are positioned too far back, especially if you try to palm the body. On some mice you can still press the rear button with the inside of a thumb joint, but not here.

What appears to be a grippy panel on the left for your thumb is also shiny and slippery, and the only part of the mouse that lights up is directly beneath the widest part of your palm, where it's completely hidden. The wheel is too low and its clicks too soft as it turns. Unusually for a device marketed as a gaming mouse, it doesn't come with software to program its buttons, but then it's also very cheap.

In the battle of the budget mice then, it's not much of a contest. We'd take the Fireglider every single time.

SPECIFICATIONS

Sensor	Optical
Max sensitivity	1,600dpi
Programmable buttons	Zero

VERDICT 4

Zalman M400

+ FLOWER Not bad for the money; USB cover.

– DOUR But we'd still take something else.

£11, www.zalman.com

AORUS THUNDER M7

Maximising its potential is a game in itself

THE THUNDER M7 absolutely reeks of quality as you open its box within a box to find a fabric case of promise lurking inside. Unzip this, and the matte-black mouse is displayed on a black lining, the sort of peripheral that makes passers-by peer over and say, "cor!"

It's a blunt mouse for sure, a black sledgehammer that's long and broad and high – claw-grippers will be fine, as long as they can lift their hairy thumbs to press the eight buttons found on the left-hand side. But this is really the domain of the more delicate palmer. Those eight buttons mark this out as an MMO mouse, a rival for the R.A.T 7 MMO rather than the Logitechs or the Asuseseses.

If forced to choose, we'd take this over the R.A.T. It's so much more comfortable to hold, and feels like it could adapt to any kind of game and style of play without overwhelming you with options like Mad Catz's insane invention. It has a hump on the right like the Element Iridium, but does it right by putting it further back and allowing the ring finger to linger on it for long periods; it's made out of clear plastic and, along with the ridge created by the line of buttons on the left, means your grip is always secure.

Stop us if we're gushing, but if it weren't for the limited appeal of MMO mice, the Thunder M7 would be a contender for a position up at the very front of this supertest. We hate to criticise (no, really, don't you believe us?) but one issue is that the wheel is merely okay. It does the job but there are simply many better ones out there, such as the CoolerMaster Reaper and the Corsair M65 in this test. Its tyre is too narrow and it sits too low.

This wasn't the best mouse we tried, but it's the best MMO mouse we tested, and that has to count for something, for someone...

SPECIFICATIONS

Sensor	Laser
Max sensitivity	8,200dpi
Programmable buttons	16

VERDICT 8

Aorus Thunder M7

+ **THUNDER** Good quality, good looks; really comfortable.

− **BLUNDER** Complicated and expensive.

£60, www.aorus.com

ROCCAT TYON

That's Tyon, not Tyrion, *Thrones*' fans

ANOTHER MMO MOUSE, the Tyon is lighter and cheaper-feeling than both the R.A.T and the Thunder – despite sharing the bulky presence of the latter – but it does have some interesting design ideas that can't be found on any of the other contenders in this supertest.

The first thing that stands out is that the buttons are not clustered around the thumb as they are on the other two MMOs – instead, it has additional switches at the sides of the main left and right buttons. These stand tall over the flat main buttons, but have sloped tops so they can be pressed with a slide of the fingertip rather than having to lift your whole finger up. After all, who's got time for that?

This is bad news for claw-grippers, as it doesn't fit into their handling structure at all well. Palmers, however, will have no problems, and the fin button on the centre-line of the mouse's back, designed to be pressed to either side by the knuckles of the index and middle fingers, makes it even clearer that this was designed with their kind of grip in mind.

The Tyon's oddest, most intriguing feature has to be the analogue switch that's operated with the thumb. It's a tiny joystick that only moves in two directions, and springs back to the centre when released. Potential uses include controlling the speed and direction of turret rotation, and it's got enough resistance to thumb pressure that it can be held precisely where it's needed. Also under the thumb, and a little too easy to accidentally press, is a shift button to switch to a second bank of custom functions.

Those who like the Tyon's idiosyncratic layout will no doubt love it, and there are certainly some sensational ideas to play around with. But it'll take a long period of time to get used to and, when something like the Thunder already exists, many won't bother trying.

SPECIFICATIONS

Sensor	Laser
Max sensitivity	8,200dpi
Programmable buttons	16

VERDICT 7

Roccat Tyon

+ **IDEA** Plenty of thought has gone into this mouse.

− **UREA** Too many people won't dedicate the time needed to master it.

£79, www.roccat.org

pcspecialist

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AND THE WINNER IS…

LOGITECH G502 PROTEUS CORE

A SUPERTEST OF GAMING MICE was always going to be a mixed bag. Anyone can take a mouse and slap a gaming label on it – a few here have done just that. "Professional gaming" in one case.

Having multiple, programmable buttons is a given, but the term has also come to mean anything with a ridiculous lighting system and a long cord. It's the versatility that's actually important, as the button setup for *World of WarCraft* is going to be radically different to that for *Evolve* or *Total War*. This is the main area where the Zalman M400 falls down, although you can still assign commands to its buttons on an individual game basis if you want, if the title allows you.

MMO mice are studded with so many additional buttons that they've become like extra keyboards, reliant on their software to map commands to where you want them. We haven't worried too much about reviewing the software in this test, as each program is dedicated to its own mouse and each program works. We didn't get a single case of a program failing to recognise that the mouse was attached, or any failures during the inevitable firmware updates. If you've been PC gaming for any length of time, you'll know this is unusual. Your mileage, as ever, may vary.

MMO mice are complex, and not always suited to a wide variety of games. If this were a test of MMO mice, the Thunder would probably win, but just in case you don't keep a special mouse for each style of gaming, we've tried to focus on those that will best adapt to the broadest range of game experiences.

That brings us to the general gaming mice. Those with only a few programmable buttons and with more conventional shapes (as long as you're right-handed, there's only one ambidextrous mouse in this test). That's why the two mice at the beginning of this supertest were chosen. They are, if you like, the winners, though we realise they won't appeal to everyone.

OF MICE AND MEN

Logitech has been doing this for a long time, and the company's G502 is currently its range-topper. So this mouse really should be good. And it lives up to expectations. It's an unfriendly-looking, angular beast, a bit cold even. But the quality of its engineering and the thought that's gone into its design mean that there's little better out there at the moment.

The Sharkoon Fireglider came as more of a surprise. We knew nothing about it and just wanted one of the cheapest gaming mice we could find – not because everybody loves an underdog, but because everybody loves a kicking. It surprised us with its versatility – even though it has a weighting system it doesn't really need – and was a comfortable mouse we could use all day long. We deliberated about putting it in the top two (is that something true hardware freaks would do? It's £15, practically a disposable product!), but in the end its user-friendliness was so impressive that it won through.

So there we go, a budget winner and a more expensive winner. The main lesson from this is that getting the basics right with a gaming mouse will lead to a superior product than slapping box-ticking, easily marketable extra features on a chassis that isn't comfortable to use for long periods or that has an absurd gimmick it relies on to attract the mouse-buying public. When someone releases a gold-plated, perfectly spherical mouse with a self-righting weight in its base and multiple laser sensors to read the walls of the room it's used in, remember this. ■

> **“The lesson is that getting the basics right with a gaming mouse will lead to a superior product.**

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What Are You Doing, Dave?

Twiddling my thumbs, impatiently awaiting the future

> "So much new tech is so tantalisingly close"

ONE OF THE CURSES of being a tech journalist is that we're always looking towards the future, finding out about new tech behind closed doors and in hushed tones. And that means the wait for it to arrive becomes utterly agonising.

Take Samsung's 850 EVO M.2 SSD, for example. It's full 3D stacked memory fare, based on an interface designed for solid-state drives to hurl data down the PCIe lanes at up to 4GB/s. Except it doesn't bother using the new super-speedy interconnect, preferring to stick to the creaking SATA interface instead, for Samsung knows what reason.

Because we know the potential of a quality SSD running over a x4 PCIe 3.0 iteration of the M.2 interface, and we know the expected performance boost the upcoming NVMe protocol is going to bring, anything that comes out in between just looks like it's treading water. And that's frustrating.

ASUS G751JY GAMING LAPTOP PG. 28

It's a similar situation with Intel. We've usually got a vague idea what the next generation of processor will look like by the time a new one arrives. But because the Broadwell situation has been so messed up, we've a situation where it's potentially only a couple of months between one desktop generation and the next. That means we're not suffering a long wait, but it also means Broadwell loses much of its shine.

Intel has been busy telling me, since September last year, that Skylake is the architecture you'll really want filling out your machine. When that all happens before Broadwell has even been released, it's really hard to get excited about something that now just feels like a stop-gap.

But we are living in exciting times. And it's the fact so many new technologies are so tantalisingly close that makes the wait for them so excruciating. I can't wait to see what the holy trinity of NVMe, full M.2 and stacked NAND will do to the performance of our SSDs and, by extension, our PCs. I'm stoked to see what Skylake can deliver with its 14nm sixth-gen Core and DDR4 memory controller. And, for the love of Lisa Su, I cannot wait to get my hands on the new AMD graphics architecture that's packing out the new Radeon R9 390X and its high-bandwidth stacked memory.

And that's just on the component side. We've also got proper VR so close you can actually touch it. Okay, the Rift is still in dev kit form, but surely it can't be much longer before the consumer version gets announced. I certainly hope not, because I'm fast running out of excuses as to why I shouldn't drop a little cash on the DK2.

I guess this utter impatience is why things like Steam's Early Access have grown so much. It means there's not such a huge gap between learning about a game and being able to play it in some form. Though given AMD's history of driver development, I'd be hesitant to spend money on a dev kit for a graphics card…

We've rarely had great experiences with early versions of graphics cards.

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OUR HARDWARE MANIFESTO

Would we buy it and should you buy it? That's all you want to know and it's all we care about. Performance and value for money are the two key pillars supporting the mighty PC Format Gold Award on its lofty pinnacle.

40
Fractal Design
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Editor's One to Watch

Are DNA drives the future of long-term storage?

HOW LONG DO YOU THINK your hard drive will last? Estimates reckon to around 10 years for spinning platters. SSDs will probably last longer in storage, while optical media can potentially stick around for about 25 years if looked after properly. A study in Switzerland though reckons it can maintain data integrity, in cold storage, for around one million years. How's it planning on doing such voodoo magic, man? Sticking that data in DNA.

The backbone of this concept is relatively old – take pairs of DNA molecule and encode them as ones or zeros. Back in 2012, scientists at Harvard encoded a 53,000 word book into DNA. Their method was to assign zeros to A (adenine) and C (cyostine) and ones to G (guanine) and T (thymine). The example given is for a lowercase 'f' to be encoded in binary as '01100110' and in DNA as 'ATGAATTC'.

The problem was that it was difficult to retrieve the data and there were gaps and errors in the data when the time came to pull it out of the DNA strands. The Swiss method though treats the DNA storage like a fossil, storing the sample in a silica shell. It survived a few weeks at 140ºF and could be read without trouble – they reckon that if stored at sub-zero temperatures such a sample would be readable up to a million years into the future.

You can also fit a huge amount of data into a small physical area of DNA. There's no other current or future technology that can compete on that front. Even the much-vaunted holographic storage tech can't get close to the level of tiny storage our molecules can potentially house.

Estimates reckon a single gram of DNA could house 455 exabytes of data. There are one billion gigabytes in one exabyte. So, right now we could encode every piece of information out there in the world into an organic-state drive with just a teaspoon of DNA. And it would likely outlast the human race. So if you want some super-secure form of data storage, stick your kid's baby photos into a DNA sample. Just don't forget where you put it.

As with all new storage technology though, the prices are pretty steep. If you thought the 50p/GB cost of SSDs rather prohibitive, you ain't seen nothing yet. The test sample the Swiss Federal Institute of Technology created housed only 83KB of data and cost around £1,000 to encode and store. Putting that in context, that works out as around £12 million/GB.

A teaspoon of DNA could potentially store all the world's data for the duration of mankind.

HIGHLIGHTS THIS MONTH...

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Gigabyte BRIX S

When docked, the laptop screen isn't used, with all the video coming from the desktop GPU. But it doesn't make for as nice a picture...

MSI GS30 2M Shadow

A laptop with a desktop GPU? What voodoo is this?

THERE ARE LAPTOP PCS, and there are desktop PCs. And never the twain shall meet. Or at least that's how it's traditionally been. This hasn't, however, stopped the industry from trying to see if there's any way to bash the two things together and see what sticks. The MSI GS30 2M Shadow, with its GPU-toting Gaming Dock, could be the closest we've come to seeing a marriage of these two disparate gaming houses.

The GS30 laptop itself is a 13.3-inch machine, with a 1080p IPS panel and a seriously slim 'n' light chassis. And just because it's got the Gaming Dock to do most of the heavy lifting doesn't mean MSI has skimped on what it's put inside the laptop. The Intel Core i7-4870HQ is a full-fat quad-core, eight-thread processor, capable of turbo-ing up to a heady 3.7GHz. Because it's a top-end CPU it's also got Intel's fastest GPU, the Iris Pro, inside. Backing that up is a massive 16GB of DDR3 memory running at 1,600MHz. So yeah, it's no slouch.

You'll even get a modicum of gaming performance, so long as you drop the resolution and your penchant for post-processing niceties. The battery isn't going to offer much, however. We were unable to get it up to an hour of gaming, running down after just 56 minutes.

QUICK CHANGE

This is where the Gaming Dock comes in. Looking like an obese soundbar, it houses a 450W PSU and comes with an MSI GTX 980 Twin Frozr graphics card installed. Plug it into the wall, attach a monitor, keyboard and mouse, and you're good to go. If you want proper gaming performance you simply shutdown the laptop, place it atop the Dock and pull the lever to lock and connect. The GS30 suddenly becomes a full desktop gaming PC with all the video coming direct from the Nvidia GPU.

The magic that connects with the desktop graphics card is a full x16 PCIe connector on the rear of the GS30. This is where all other external GPU designs have fallen down. The XG Station that Asus spent years trying to figure out used the old Express Card standard, which only supported a PCIe 1.1 connection at x1 speeds. The new Gaming Amplifier with the Alienware 13 laptop does use a PCIe 3.0 connection, but even that can only manage x4 speeds, hobbling any connected GPU.

MSI's solution uses the full power of the desktop card, which is shown in our benchmark results. The numbers are only ever a few fps on average behind our Z97 test machine with a Core i7 and reference GTX 980. This is why the GS30 comes with a top-end mobile i7 in its make up.

The benefit of having this powerful a CPU is that it's going to outlast even the GTX 980 in terms of gaming relevance. When you do come to plumbing a new desktop GPU into the Dock, the Core i7 will still have the necessary performance to keep up. The same goes for the 16GB DDR3 too – it's going to be a long while before these become minimum requirements.

Hurrah then, we've finally got an external GPU adaptor for a laptop that just works. But there are teething problems. The cooling for the laptop CPU is loud and isn't capable of maintaining the 3.7GHz peak it initially offers. When you're gaming, the whole thing is certainly not quiet, no matter how chilled out MSI's Twin Frozr cooling is on its GTX 980.

And that card is another issue. The fact you have to have the most expensive GPU that MSI offers is a bit of a problem for us. That will change though. We've learned Scan has ordered a load of empty units from MSI on the proviso it can only package it with MSI graphics cards; though that does include *any* MSI card. That will help ease back the currently sky-high price tag and make it potentially interesting for the upgraders. With an empty dock you could port over your existing GPU and storage from a desktop rig and have a powerful little notebook that can transform into a desktop PC at the drop of a hat.

MSI admits itself the GS30 is a very niche product and the Dock especially feels very first-gen. The biggest problem though is that it feels very much like the package has compromised both its ability to be a desktop PC as well as a decent notebook.

EYE ON THE FUTURE

The lack of battery life on this otherwise lovely notebook is a cardinal sin. You'd want such a device to be able to run all day in general productivity terms, but you wouldn't even be able to watch a feature film without plugging in. That four-cell battery isn't enough to keep the top-end CPU running for long. And when combined with the dock, the volume of noise the system creates is incredibly distracting, especially as you're likely to have it sat next to you on your desktop. Right now a cheaper gaming notebook, like the G751 over the page, will deliver a better docked experience, if not quite with the same fps.

Okay, you won't have the luxury of a GPU upgrade down the line, but you'll have a quieter, longer-lasting gaming session right now, for a lot less cash too. We're glad MSI has made the GPU dock work, but now we need a little more refinement.

–DAVE JAMES

VERDICT
7

MSI GS30 2M Shadow

+ THE SHADOW Unfettered desktop gaming performance; lovely thin 'n' light laptop; versatile Dock; easy to set up and use.

– ALEC BALDWIN Noisy laptop cooling; super-expensive; feeble battery life; worth waiting to be able to buy empty Dock.

£2,200, www.msi.com

BENCHMARKS

	GS30	GS30 with Gaming Dock	PCF test rig
Cinebench R15	612	636	**783**
X264 v4.0	35.24	36.81	**53.28**
Heaven 4.0 (min/avg fps)	3.6/5.9	26.5/74.7	**29.2/75.3**
Bioshock Infinite (min/avg fps)	2/9	17/120	**16/125**
GRID 2 (min/avg fps)	13/18	**130/165**	116/147
Metro: Last Light (min/avg fps)	3/6	27/53	**32/53**

Best scores are bolded. All graphics tests were carried out at 1080p with 4x AA. The *PCF* test rig is an Asus Maximus VI Hero motherboard with an Intel Core i7-4770K @3.5GHz with 8GB RAM and an Nvidia GTX 980 reference.

SPECIFICATIONS

Screen	13.3-inch
Native resolution	1920 x 1080
CPU	Intel Core i7-4870HQ
GPU	Intel Iris Pro 5200, MSI GTX 980 Twin Frozr in Dock
Memory	16GB DDR3L
Storage	2x 256GB M.2 SSD Super RAID
Dimensions (W x D x H)	320 x 227.3 x 19.8mm

GAMING CENTER
G751JY
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Audio Wizard
Multimedia
NVIDIA GeForce
Experience
29.8 GB available
Memory32 GB
2.2 GB Used
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51 GB Used
Thursday, February 12, 2015
11:24 AM
REPUBLIC OF GAME
ASUS

The G751JY may not have the svelte looks of the thin 'n' light crowd, but it's more powerful. And quieter.

Asus G751JY

In the face of powerful desktop parts powering other laptops, can Asus's mobile gamer compete?

THE CLASH OF THE DESKTOP REPLACEMENTS. That's how we've started this month's reviews and it's a proper battle royale. Except without the screaming kids, the fountains of blood and 'Beat' Kitano. First we had MSI's new take on the hybrid laptop (see page 26) – all gaming dock, upgradeable GPU and floaty-light notebook fun – and now we have Asus's beefy trad gaming laptop, the G751JY.

And it's a hulking great beast of a machine. We're not just referring to it being a hefty 17.3-inch notebook weighing nearly five kilos – it's also packed full of the best mobile hardware money can buy. Which is lucky, considering how much it costs.

The processor is top-end mobile Haswell fare, a fully-Hyperthreaded Core i7 capable of running up to 3.5GHz in this chassis, with a huge – if mostly unnecessary – 32GB of DDR3 memory, an M.2 512GB SSD (the Samsung XP941, reviewed in PCF300) with a 1TB HDD and an Nvidia GTX 980M. The keyboard and trackpad are worthy of note too. There are extra macro keys and buttons to launch Steam's Big Picture and Nvidia's game streaming software, while the trackpad is wide and responsive, with a pair of discrete buttons. It's so much better than the all-in-one trackpad abortions we've got Steve Jobs to blame for.

For the gaming performance, it's the range-topping Nvidia GPU that will get all the plaudits, but the screen Asus has used deserves a mention too. It's stunning. The 17.3-inch IPS panel has a native resolution of 1920 x 1080, but impressively the screen also runs at 75Hz. That's just 15Hz over the traditional 60Hz, but it makes a visible difference. Even before catching the numbers in the Nvidia control panel and game settings screens, we'd been impressed with the clarity and smoothness – this is a quality modern notebook screen. And it's no surprise it's the panel we've seen doing the rounds running the leaked mobile G-Sync driver to such good effect...

RIGHT RES?

You may be less impressed by the 1080p resolution of that panel, but it's still an excellent option for a gaming notebook with a tight pixel pitch on a small screen. Put simply, it runs beautifully at that res. There's also the fact that higher resolution panels just aren't available in IPS trim at this size in decent or affordable volume.

That GTX 980M though does help make the screen look good, hurling around textured, tessellated polygons at fantastic frame rates. The Maxwell GPU isn't quite on a par with the desktop GTX 980 sat inside MSI's Gaming Dock, running to about 75 to 80 per cent of that full-fat graphics silicon. But that still makes it more than a match for any 1080p games you wish to throw at it, and thanks to the chilled-out Maxwell architecture, it runs seriously quiet too.

You've also got the Asus chassis design to thank for that too. The thin 'n' light movement is all well and good for the notebook you take into meetings or sit with on the sofa, distracting you from the human horrors of your girlfriend binge hate-watching *Geordie Shore*. But for a gaming laptop, packing components which really benefit from proper thermal attention, you need some girth in your chassis so you don't end up with the whining fans spinning up in a rushing cacophony.

NOT SO SHOUTY

That's one of the things which spoils the MSI GS30 2M Shadow. Even when it's docked, the cooling on the CPU is always noticeable. Add in the low-level, but still persistent, noise of the Gaming Dock's GPU and PSU fans and you get an experience which is far from ideal. The G751JY on the other hand is whisper quiet even at full tilt. And that makes it a great desktop replacement to use as a docked machine too. Plug in a keyboard and mouse, output to a decent monitor and you'd be hard-pushed to tell you weren't gaming on a full-fat tower PC.

And while we're comparing it with the MSI, this chunky, powerful gaming laptop will last longer away from the plug socket too. The eight-cell battery, combined with the low-power Maxwell chip, managed an extra eight minutes of gaming time against the svelte GS30 with its four-cell battery. It may not sound a lot, but that puts it at over an hour of high-quality gaming – and the gap increases when you're just watching video to over 40 minutes extra.

Asus's G751JY may not have the upgradeability or gaming power of the MSI's Gaming Dock, but right now this chunky machine is a much better option, both on the go and plugged into a desktop monitor. Plus it costs a good deal less. **–DAVE JAMES**

VERDICT 9

Asus G751JY

+ GAMER Gaming performance; excellent screen; decent battery life; whisper quiet.

− GATER Heavy; still deliriously expensive.

£1,823, www.asus.com

BENCHMARKS

	Asus G751	MSI GS30 w/Dock	Gigabyte P35X v3
Cinebench R11.5	6.74	6.90	**6.94**
Bioshock Infinite (min/avg fps)	15/95	**17/120**	9/86
Metro: Last Light (min/avg fps)	23/42	**27/53**	19/41
Shadow of Mordor (min/avg fps)	34/69	**38/87**	38/65
Price	£1,823	£2,200	£1,549

Best scores are bolded. All the gaming tests were carried out at 1080p on the highest game settings with 4x AA, with the minimum frame rate in parentheses and the average frame rate following.

SPECIFICATIONS

Screen size	17.3-inch
Screen type	IPS
Native resolution	1920 x 1080 @ 75Hz
CPU	Intel Core i7-4860HQ @ 3.5GHz
Memory	32GB DDR3L
Graphics	Nvidia GTX 980M
Storage	512GB Samsung XP941 SSD, 1TB HGST HDD

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intel inside CORE i7

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- Intel® Core™ i7 5820K Overclocked to 4.4GHz
- Two 4GB NVIDIA GeForce GTX 980 in SLI
- 16GB Corsair Vengeance 2666MHz DDR4
- 500GB SSD + 2TB HDD

THIS SPEC, FROM £3556 Inc VAT

The X99 Cyclone SLI is a fully water-cooled PC that features a hex-core Intel® Core™ i7 5820K CPU with Hyper-Threading which we overclock to 4.4GHz for amazing performance in your favourite games. It also has two 4GB NVIDIA GeForce GTX 980s graphics cards, which are also water-cooled so remain cool and quiet even in the most frantic games. Also included is 16GB of 2666MHz Corsair Vengeance DDR4, an Asus X99-S motherboard, a 500GB Samsung Evo SSD and a 2TB hard disk.

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Scan manufactures over 1,000 custom-built systems per month, so whether you want a ninja gaming rig, a small form factor media PC or a gaming laptop we can spec it and build it for you. Here are nine featured systems from our huge range, all of which can be fully customised with different components and cases.

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★★★

You don't have to spend a fortune to get a PC that can play the latest games. Our 3XS systems are competitively priced so you have more money to spend on buying and experiencing new games.

intel inside PENTIUM

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- 8GB Corsair Vengeance Pro 2133MHz
- Arctic Cooler Freezer 11i

£259

intel inside CORE i7
expertreviews BEST BUY
PC ADVISOR RECOMMENDED

Scan 3XS Graphite LG156

- Intel® Core™ i7 4710MQ
- 8GB Corsair Vengeance DDR3 1600MHz
- NVIDIA GeForce GTX 860M
- 1TB HDD
- 15.6" 1920 x 1080 screen

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intel inside CORE i5
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- Intel® Core™ i5 4460
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- 1TB HDD

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★★★★

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intel inside CORE i5

3XS Z97 OC10

- Intel® Core™ 4690K overclocked to 4.6GHz
- Asus Z97-P Motherboard
- 8GB Corsair Vengeance Pro 2133MHz
- Phanteks U-Type

£399

intel inside CORE i7

Scan 3XS Graphite LG1720

- Intel® Core™ i7 4720HQ
- 8GB Corsair Vengeance DDR3 1600MHz
- NVIDIA GeForce GTX 970M or 980M
- 1TB HDD
- 17.3" 1920 x 1080 screen

£1156

intel inside CORE i5

3XS Z97 Performance GTK5

- Intel® Core™ i5 4690K overclocked to 4.6GHz
- 8GB Corsair Vengeance Pro 2133MHz
- 4GB NVIDIA GeForce GTX 970
- 240GB SSD
- Water-cooled whisper quiet

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GAMING EXPERIENCE: GODLIKE

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Unlock your true gaming potential with one of our 3XS systems. These no compromise systems provide the very best in frame rates in games thanks to their combination of overclocked CPUs and graphics cards.

intel inside CORE i7

3XS Z97 OC15

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- 8GB Corsair Vengeance Pro 2133MHz
- Corsair water-cooler

£559

intel inside CORE i7

Scan 3XS Graphite LG1725

- Intel® Core™ i7 4710MQ
- 8GB Corsair Vengeance DDR3 1600MHz
- Dual NVIDIA GeForce GTX 970M or 980M in SLI
- 1TB HDD
- 17.3" 1920 x 1080 screen

£1579

intel inside CORE i7
PC GAMER EDITOR'S CHOICE ★★★★★
HEXUS PERFORMANCE

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THE FUTURE OF PERFORMANCE solid-state drive storage lies with the PCIe interface. Set to usher in a new era of superfast SSDs, the M.2 storage interface is shovelling huge amounts of data down speedy PCIe lanes. And we're starting to see the green shoots of its continued development right now. More and more manufacturers have started to release M.2 drives, with the socket appearing in many new laptops and mainstream motherboards.

There's also the tantalising prospect of the Non-Volatile Media Express protocol (NVMe) replacing the current AHCI setup, itself hobbling even the fastest PCIe SSDs with its many mechanical legacy hoops that SSDs still need to jump through. On top of that, thanks to Samsung's latest range of consumer drives, we're also getting 3D NAND Flash memory to sort out the storage density and longevity issues we've been suffering with.

So Samsung releases an M.2 850 EVO – the very drive range with its vertical, or V-NAND, memory – and we get all excited. Could this be the holy trinity of SSD advancement, a solid-state drive with 3D stacked memory, operating on the latest M.2 PCIe interface with the new NVMe protocol? Would that it were, dear reader. Would that it were...

HIGH HOPES

We can discount NVMe immediately. That much vaunted SSD-specific protocol is still a while away from landing in our desktops. But we've still got an M.2 drive, right? Well, this is where things get really frustrating. Yes, the 850 EVO M.2 has been designed in that form factor, but it's using a little-known component of the M.2 interface – SATA. As well as providing a connection to the PCIe lanes of a motherboard, and support for both the AHCI and NVMe protocols, M.2 can also provide legacy support, plumbing directly into the SATA interface.

What we have here then is an M.2 drive that's unable to actually take advantage of this new interface properly at all. It doesn't matter if you plug it into a x2 or x4 slot, it will still just route everything straight through to SATA, suffering all the bandwidth limitations that the aging interface offers. Samsung is claiming this drive is designed for the consumer market, for those looking for a decent SSD upgrade for their M.2-sporting thin 'n' light notebooks. That's especially frustrating considering Samsung is still refusing to release its speedy XP941 or upcoming XP951 M.2 drives to the consumer market despite this tacit acknowledgement that consumers are ready to mess about with bare PCBs in their notebooks.

What's also tricky is that support for this bizarre subset of the M.2 interface is very limited when it comes to desktop motherboards. We went through all the Asus boards we have in the office with M.2 interfaces – and a PCIe expansion board too – and none supported it. Thankfully our ASRock X99X Killer Fatal1ty did, otherwise we wouldn't have got to be underwhelmed by the 850 EVO M.2's performance at all. At least not first-hand.

And underwhelming is definitely the word. If it were performing at the same level as the 2.5-inch drive that would still be mildly disappointing for an M.2 form factor but, considering its SATA limitations, not surprising. That, however, is not the case. Sequential read and write performance is on a par with what the 2.5-inch version can manage, namely sitting around the 500MB/s mark characterising most current-gen SSDs, but the random 4K performance is well off the pace.

NOT WHELMED AT ALL...

The standard drive hits 36MB/s and 108MB/s respectively – about as fast as 4K performance gets right now – but this M.2 SATA version can only manage 22MB/s and 62MB/s. Those numbers are far from awful, but lag significantly behind the bargain £150 MX100 512GB drive. It's the same story for our real-world tests too, where it's half a minute behind its 2.5-inch sibling when it comes to our large Steam folder transfer. That's an enormous difference in performance.

We understand Samsung wants this to be an affordable drive for the thin 'n' light upgrade market, but releasing an M.2 drive without the expected performance benefits just seems odd. Especially when it plain refuses to properly release its super-quick XP941 to the public. So we're struggling to see why anyone would want this drive for their machine long-term – and by the looks of it cutting the 850 EVO's five-year warranty down to just three years for the M.2 version, Samsung's struggling too.
–DAVE JAMES

VERDICT
6

Samsung 850 EVO M.2

+ EVO Small; runs cool.

– EGO SATA limited; cut-down warranty; weak real-world performance; weak random 4K speeds.

£195 (TBC), www.samsung.com

BENCHMARKS

	Samsung 850 EVO M.2	Samsung 850 EVO	Crucial MX100
AS SSD seq. read (MB/s)	**505**	494	499
AS SSD seq. write (MB/s)	**488**	485	474
AS SSD 4K read (MB/s)	22	**36**	24
AS SSD 4K write (MB/s)	62	**108**	106
5GB compression (sec)	79	**74**	**74**
30GB transfer (sec)	235	208	**191**

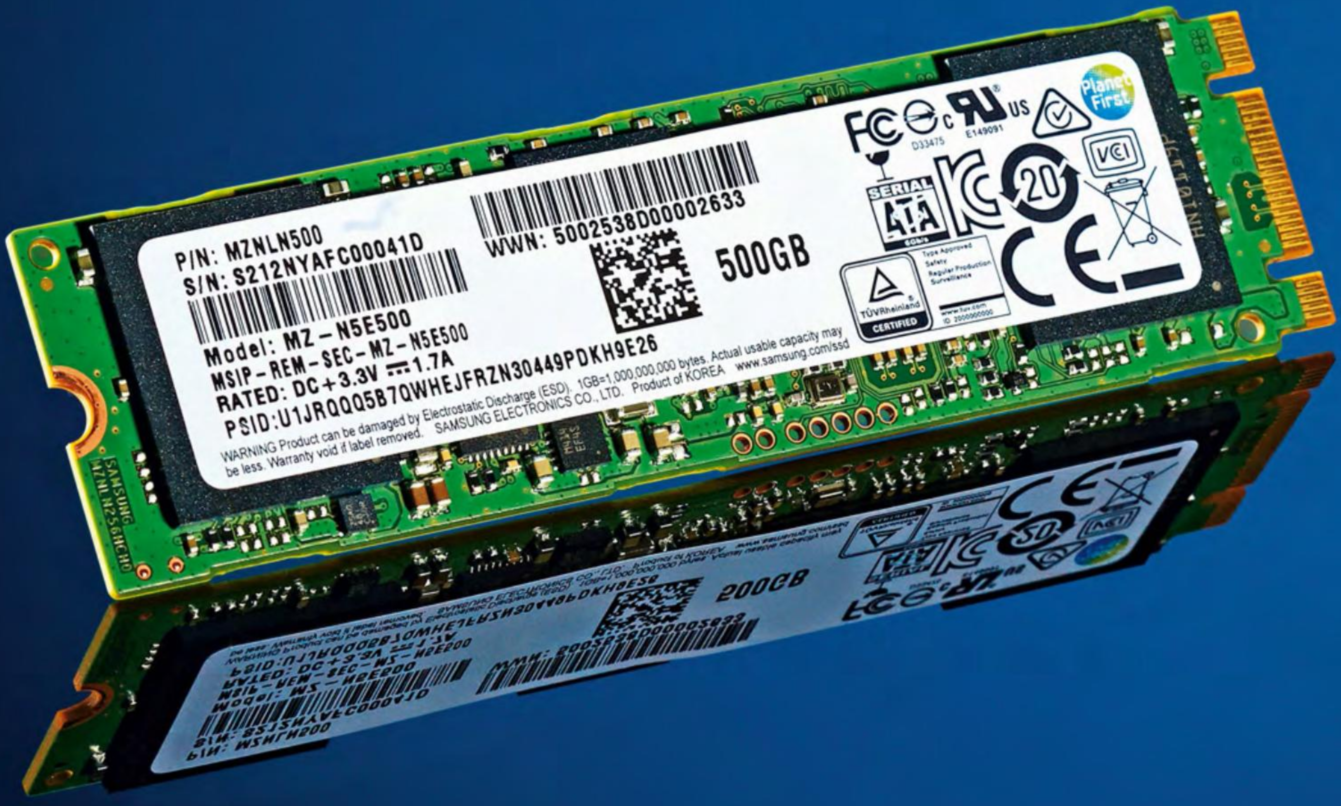
Best scores are bolded. The M.2 drive was tested on an ASRock X99X Killer Fatal1ty motherboard with an Intel Core i7-5820K, with 16GB DDR4 at 2,133MHz. The 2.5-inch drives were tested on an Asus RoG Maximus VI Hero with an Intel Core i7-4770K, with 16GB DDR3 at 2,133MHz.

SPECIFICATIONS

Capacity	500GB
Form factor	M.2 2280
Interface	SATA 6Gbps
Memory controller	Samsung MGX
Memory type	Samsung 40nm 3-bit MLC V-NAND
Cache	512GB LPDDR3
Warranty	Three years

Samsung 850 EVO M.2

An M.2 SSD in name only



We're still waiting for that M.2 drive to arrive and deliver on the promise of PCIe storage.

Alienware Alpha

A great console-sized PC stuck in the alpha stage

The box's aesthetics aren't very flashy, but will look nice sitting next to your TV.

LET'S FACE IT, consoles have the PC beat in the living room. Alienware and the Steam Machines were supposed to change that, but we all know the saga of the Valve delay, while Alienware has decided to release its box early as a small Windows 8.1 PC, dubbed the Alpha. It does an admirable job of attacking the PC's problem areas in the living room, but unfortunately (as the name implies), it's still got some way to go.

Black and small, measuring 2.1 x 7.8 x 7.8 inches, the Alpha is closest in size to Nintendo's Wii U, and we had an easy time lugging it around with four controllers inside a backpack. Speaking of controllers, it comes with a black wireless Xbox 360 controller. Inside the box, the Alpha packs a mobile GPU, based on Nvidia's GeForce GTX 860M, that runs at 1,020MHz and has 2GB of GDDR5 VRAM clocked at 1,253MHz. Since the Alpha has such a unique setup, we opted to use an HP Omen gaming laptop as a test bed machine to compare the Alpha's benchmark results against. Pitted against the Omen, however, the Alpha's performance was a disappointing 11 per cent slower in our *Metro: Last Light* and 3DMark 11 benchmarks. It did, however, perform 7 per cent better in *BioShock Infinite*. Overall, the Alpha is nowhere near the most powerful gaming PC out there, but it should compete with the PS4 and Xbox One.

TAKING CONTROL

A couple of key base aspects not up to snuff are the 4GB system RAM and the 500GB 5,400rpm hard drive, which ran embarrassingly slowly. Luckily, you can upgrade the RAM to 8GB and upgrade the storage with any 2.5-inch drive. You'll really want to do this.

It's a similar story with the Alpha's i3-4130T CPU, a dual-core desktop CPU running at 2.9GHz. You can upgrade this to a quad-core i5 or i7. And you may want to, considering this i3 gets beat by 30 to 54 per cent compared to the Omen's mobile i7-4710HQ processor. Dual-core CPUs are fine for most games, but we'd have preferred a quad-core for a little more future-proofing.

Better is Alienware's interface, which has been wrapped around Win8.1 and can be navigated with a controller. The Alpha UI also allows you to launch directly into Steam Big Picture Mode, and Alienware has even made some nifty tweaks to allow you to use an Xbox controller like a mouse.

One of the Alpha's taglines is that it "combines the freedom of PC gaming with the ease of a console", but the slogan doesn't always ring true. We encountered resolution issues. In *Shadow of Mordor*, for instance, it defaulted to 1280 x 1024 on our 1080p TV and had no in-game option to adjust it to 1080p. Some games allowed us to adjust the resolution, but blacked out the screen when we cranked it up to 1080p.

At almost £450, the Alpha isn't cheap, especially when you look at its specs and compare it to the consoles. And it has a bunch of software hiccups to overcome. But when it works, it's fantastic. Sure, you could build a cheaper, more powerful system, but Alienware has spent a decent amount of R&D trying to solve the software/UI issues. Yes, it's still in an alpha stage and isn't yet the console-killer it set out to be, but we hope Alienware develops it further. As it stands, the Alpha is a good machine for the PC vet, but not perfect for the console noob.

–JIMMY THANG

VERDICT

7

Alienware Alpha

+ ALPHA Very portable; brings PC gaming to the living room.

− BETA Can't upgrade GPU; slow hard drive; only 4GB of RAM; still some bugs to iron out.

£449, www.alienware.com

BENCHMARKS

	TEST RIG	
Stitch.Efx 2.0 (sec)	989	1,526 (-35.2%)
Proshow Producer 5 (sec)	1,604	2,305 (-30.4%)
x264 HD 5.0	13.9	6.4 (-54%)
Bioshock Infinite (fps)	50.9	54.4
Metro: Last Light (fps)	49.6	44 (-11.3%)
3DMark 11 Perf	5,071	4,510 (-11.1%)
		0% 5% 10% 15% 20% 25% 30% 35% 40% 45% 50%

Our test rig notebook is an HP Omen with a 2.5GHz Intel Core i7-4710MQ, 16GB DDR3/1600, 512GB SSD, a GeForce GTX 860M and Windows 8.1. *BioShock Infinite* tested at 1920 x 1080 at Ultra DX11 settings; *Metro: Last Light* tested at 1920 x 1080 at DX11 medium quality settings with PhysX disabled.

SPECIFICATIONS

CPU	2.9GHz Intel Core i3-4130T
RAM	4GB DDR3 1,600MHz
GPU	Nvidia GeForce GTX 860M
Storage	500GB 5,400rpm HDD
Connectivity	HDMI (out and in), S/PDIF, 3x USB 2.0, 2x USB 3.0, Bluetooth 4.0, 802.11ac
Weight	2kg

Chillblast Fusion Mantis

A mid-range gamer falling prey to its big brother

THE RELEASE OF NVIDIA'S GTX 960 should in theory have brought about some well-priced gaming rigs using the latest Maxwell-based mid-ranger. So, we wanted to lure into the *PCF* testing lab a sub-£1,000 machine rocking the green team's latest graphics card, with its super-chilled GPU and 1080p gaming prowess. Step forward the Chillblast with its Fusion Mantis and a retail price of around £850.

And it's certainly a neatly built mid-range machine. Aside from the MSI-branded GTX 960, with its Twin Frozr cooler, you get a Devil's Canyon i5 tripping along merrily at 4.3GHz in easily overclocked trim. There's a 120mm Corsair water cooler keeping the temperature and noise down, 8GB DDR3 memory and a 1TB Seagate SSHD, all plugged into a slimline Gigabyte Z97-HD3 motherboard. That seems like pretty standard, mid-range gaming fare, and at the traditional 1080p resolution the Mantis nails smooth, high frame rates in the latest games running at their highest settings.

SIBLING RIVALRY

We even saw the bundled GTX 960 offering some relatively decent numbers when we pushed things up a level to 1600p. The limited memory bus and frame buffer on offer with this Maxwell mid-ranger though precludes us from really recommending such a card for anything above 1080p, if you've got any thought to the future of PC gaming. At that resolution you can be pretty confident the card will keep on trucking for a good few years of game releases. Anything higher and you're likely to run into some memory issues pretty soon.

This means that there's a pretty simple answer. If you can spare the extra cash, you should go for the recently maligned GTX 970 in config options. It may not have full access to all of its 4GB frame buffer, as was initially thought, or have the total ROP count we were originally told it housed, but it's still an excellent GPU for the money. That configuration does though push the price of the Fusion Mantis up to over the £1,000 mark.

But so far, all pretty standard stuff. A nice and tidy PC build, basically sacrificing SSD speed for a decent gaming GPU and an overclocked processor. But that's not the whole story. The M. Night Shyamalan twist at the end is one of a ghostly older brother looming spookily over proceedings.

That ghoulish sibling is Chillblast's own Fusion Trigger, the spectre of which still haunts the benchmark spreadsheet in which we entered the Mantis's performance numbers. The original machine that we reviewed also ran to £850, but came with an older Haswell i5 – still clocked to 4.3GHz – and a GTX 770. It was that beefier GPU which gave the older machine the edge across our benchmark suite.

So we checked to see if it was still available at that price. It's not. It's now crept up to £899. The kicker though is that it's now specced out with a GTX 970 instead. The rest of the spec is almost identical when compared to the Mantis, except it uses a different chassis and cooler.

TRIGGER HAPPY

That means you also get Chillblast's excellent two-year collect and return warranty, along with a further three-year labour cover. This seems part of the problem of system integrators offering so many different machines and so many configuration options – choice is great, but when they can't keep track of the relative pricing of their builds, how can the consumer be expected to?

The choice then is a relatively simple one. With only £50 between the two machines, and the GTX 970 costing at least £100 more than the GTX 960 in retail, we would have to recommend the Fusion Trigger over the Mantis. Putting the two machines side-by-side makes this GTX 960-toting machine suddenly look a little lacking in the value department. **–DAVE JAMES**

VERDICT
7

Chillblast Fusion Mantis

+ MANTIS Neat; clean build; quiet; good performance.

– STICK INSECT Only slightly cheaper than the better-performing Trigger.

£849, www.chillblast.com

BENCHMARKS

	Chillblast Fusion Mantis	Chillblast Fusion Trigger (with GTX 770)
Cinebench R15	640	**649**
X264 v4.0 (fps)	**43.48**	43.40
Heaven 4.0 (min/avg fps @ 1600p)	6/20	**7/26**
Bioshock Infinite (min/avg fps @1080p)	22/73	**22/87**
Battlefield 4 (min/avg fps @1080p)	58/69	**39/73**

Best scores are bolded.

SPECIFICATIONS

CPU	Intel Core i5-4690K @ 4.3GHz
Motherboard	Gigabyte Z97-HD3
Memory	8GB DDR3 @ 1,600MHz
Graphics	MSI GTX 960
Storage	1TB Seagate SSHD
Warranty	Two-year collect and return, plus three-year labour

If you can handle the four-figure price, it's worth upgrading to the GTX 970.

That radiator is a bit of a big beastie – not one for the more compact case.

Corsair Hydro H110i GT

An effective and quick all-in-one liquid cooler that's easy to install

LONG ONE OF THE MAJOR PLAYERS bringing liquid cooling out of the geeky world of overclocking and into the mainstream, Corsair has led the way with a range of AIO coolers that are easy to install and offer no worries over maintenance. The H110i GT is the latest addition to its Hydro range, and sits between the feature-rich H100i and the performance H110 coolers.

Although the H110i GT is in the 280mm radiator class, the whole radiator assembly is somewhat larger at 322mm long – so this isn't a cooler for the more compact case. The radiator is home to the two 140mm SP140L high static pressure fans. And if you're wondering what the holes in the inner frames of the fans are for, they're to add your own preference of LEDs, of course.

Installation is pretty straightforward. Well, a doddle actually. Four standoffs are screwed into the backplate, the pump mount bracket is placed over the pump, and then the whole unit is fixed in place by four thumbscrews. We had a bit of a shock when the standoffs were screwed into the backplate – we'd expected things to be held tightly in place, so were alarmed to find this was far from the case. A quick glance in the manual revealed the "backplate may still have some leeway depending on your motherboard", so that's alright then. Leeway. Phew.

The one thing you do need to make sure of before you install the H110i GT is that you have a spare SATA power connector, as this is what the pump uses for power. There's also a 3-pin cable from the pump that needs connecting to the CPU fan connector on the motherboard so it can report pump RPM. And finally there's the USB cable that plugs into the pump and into a USB header on the motherboard – this is for the Corsair Link utility. The whole lot needs plugging in for the software and hardware to play nice together.

HYDRO POWER

Corsair's Link software is a very useful tool, allowing you to pretty much control how the H110i GT works to a very fine degree. The speed of the pump can be altered, as can the two cooling fans. For the fans there's a wide choice of pre-set options, or they can be finely tuned using a custom curve. It even lets you configure the pump's LED colouring. There's hours of tinkering to be had here, if you're that way inclined.

At the i7-4770K stock clock the fans ran pretty quiet, a quick glance at Link showing an average speed of just 519rpm at the default setting. At 100 per cent load they're still almost as quiet, spinning away at an average 718rpm. At an overclocked 4.5GHz idling, the fans were spinning at much the same speed as default. However, loading the overclocked processor to 100 per cent got the fans spinning at around 1,200rpm, and noticeably louder. But more importantly, the cooler was struggling to keep the processor below 90 degrees.

Changing the fans' profile to Performance mode in Corsair Link saw them running at an average of 1,800rpm and becoming pretty loud again, but vitally dropping the CPU core temp down below 90 degrees. Also in Performance mode the cooler was stunningly quick to get the cores down to the idle temperature of the overclocked processor when it was switched from 100 per cent load. And in an overclocked rig, that's important.

So the Hydro H110i GT fits neatly between its two siblings, while its ease of installing should calm the nerves of anybody new to the dark art of liquid cooling. And by using the Corsair Link software it can be tuned perfectly for any system, which is handy as the fans are noisy when they're set to run at a high rpm. –SIMON CRISP

BENCHMARKS

	Corsair H110i GT	Fractal Design Kelvin S24
Reference CPU 100% load (°C)	55	**49**
Reference peak-to-idle (sec)	240	**166**
Overclocked CPU 100% load (°C)	82	**76**
Overclocked peak-to-idle time (sec)	**50**	182

Best scores are bolded. The tests were run on an Asus RoG motherboard with an Intel Core i7-4770K at 3.5GHz reference and 4.5GHz overclocked. CPU load was tested using a run of Prime95 for 20 minutes.

VERDICT 7

Corsair Hydro H110i GT

⊞ **COOL** Easy to install; quick to cool; impressive Link software.

⊟ **FOOL** Expensive; can get loud.

£101, www.corsair.com

SPECIFICATIONS

Socket compatibility	Intel and AMD
Water block	Pure copper
Fan(s)	2 x 140mm
Radiator dimensions (L x W x H)	140 x 322 x 27mm
Warranty	Five years

*Case for illustration only

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- 16GB DDR3 1866MHz Memory
- 2TB SATA III - 6GB/s 7200rpm HDD
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- Microsoft Windows® 8.1
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- 8GB DDR3 1866MHz Memory
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- 8GB DDR3 1866MHz Memory
- 1TB SATA III - 6GB/s 7200rpm HDD
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Elite 970 Special

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System specifications
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- **MSI B85M - E45** Motherboard
- 4GB NVIDIA GTX 970 Gaming
- 8GB DDR3 1866MHz Memory + 120GB SSD
- 2TB SATA III - 6GB/s 7200rpm HDD
- Zalman Z3 Plus Gaming case
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- **Lifetime Gold Warranty***
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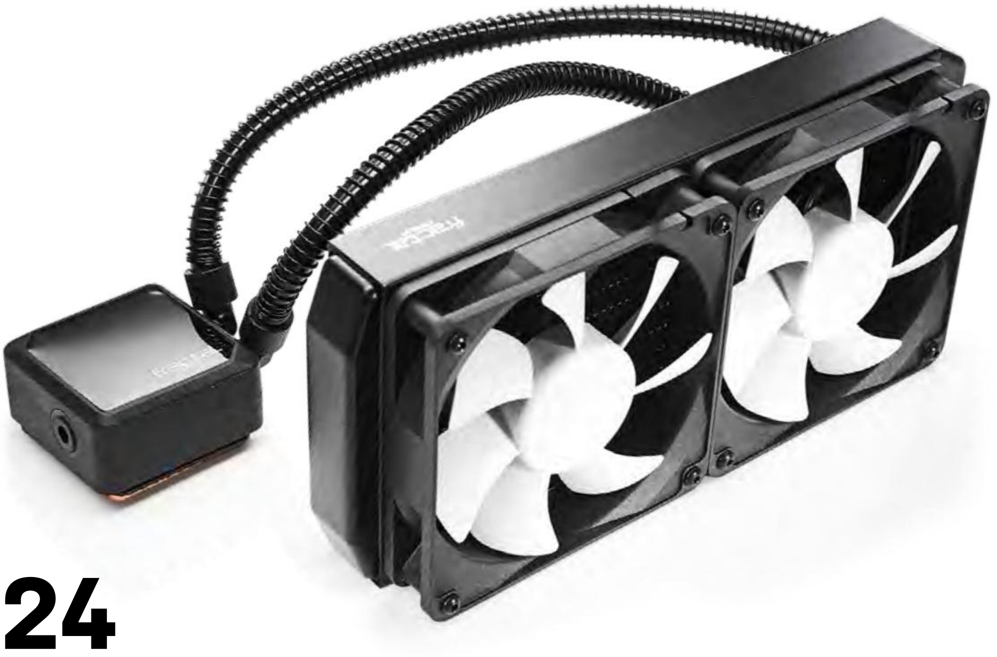

Fractal Design Kelvin S24

An AIO liquid cooler with an expandable waistline

SWEDISH CHASSIS MAFIA Fractal Design is well known for its range of PC cases, but now it's got a range of AIO liquid CPU coolers too. 'Range', however, may be a bit too grand a word to use for just three products. Whatever, Fractal has called on the expertise of Alphacool, a company that knows a thing or two about liquid cooling. The dual-fanned Kelvin S24 is the middle cooler in the setup, sitting between the single fan T12 (120mm radiator for £75) and the triple-fanned S36 (360mm radiator for a princely £105).

Although the entire Kelvin set comes as all-in-one kits, they're really more like hybrids between an AIO and a DIY design. They've been created to be expandable, not expendable, so it's possible to add another CPU block or a GPU block if so desired. Fractal has fitted the pump and radiator with standard G quarter-inch threads, making this job even easier as it opens up the options available to expand the system. The pump is also designed to be topped up if need be with a fill port fitted on one side for this very purpose.

The S24 has been ambitiously Fractal-designed to handle up to two CPUs and one or two GPUs. The water block and pump unit is quite compact at 69 x 69 x 40mm and said pump has a ceramic bearing and runs at 2,400rpm. That produces a water flow of 72l/hr and has Dry Run Protection designed into it so it can still run without damaging itself should the system run out of water, though the same may not be true for your silicon. Especially if it's started gasping for the wet stuff thanks to an errant untightened bolt.

Two 320mm long tubes run from the block to the 275mm radiator, and have anti-kink coils fitted to them. Both the cooler block and radiator are made from pure copper. Keeping everything cool is a pair of Fractal's own Silent Series 120mm fans which are PWM controlled with a decent spin range of 800 to 1,700rpm.

A HEX ON YOU

Fitting the S24 is straightforward thanks to yet another superb Fractal manual which shows all the steps with highlighted diagrams. We did have a bit of niggle joining the two halves of the mounting bracket together, but it may have just been our unit. Once they're together though there's no getting them apart without resorting to some serious tools. But despite that, the rest of the fitting is super simple.

The pump fixes to the backplate via four thumbscrews which use springs to prevent over-tightening. The longest job is screwing in the eight Hex screws which fix the two fans to the radiator. It may seem annoying for Fractal to use Hex instead of normal screws, but thankfully a Hex key is in the parts bundle. Woe betide anyone who dares lose their Hex however.

The S24 performed well in testing and kept our i7-4770K at just 17°C while idling with no real noticeable noise coming from either the pump or the fans. With the processor loaded to 100 per cent, the fans still remained very quiet and the cooler kept the CPU at a very reasonable 49°C. Even when overclocked to 4.5GHz the fans remained quiet at idling with the temperature of the CPU at 21°C. However, loading the CPU to max in its overclocked state meant the fans became very noticeable, not screaming banshees admittedly, but still pretty loud while the temperature was kept at a toasty 76°C.

But it's this overclocked performance which has us leaning more towards the new Corsair cooler. When you're thrashing your silicon with high frequencies, you want it to get back down to its idle temp as quickly as possible and the S24 takes far longer than the H110i GT and its similarly fat fans. Overall then, the S24 is a neat, simple, expandable AIO cooler, but the slow peak-to-idle performance and loud fans makes it a tough choice for the serial overclocker. –**SIMON CRISP**

BENCHMARKS

	Fractal Design S24	Corsair H110i GT
Reference idle temp (°C)	**17**	21
Reference peak temp (°C)	**49**	55
Overclocked peak temp (°C)	**76**	82
Overclocked peak-to-idle (sec)	182	**50**

Best scores are bolded. The tests were run on an Asus RoG motherboard with an Intel Core i7-4770K at 3.5GHz reference and 4.5GHz overclocked. CPU load was tested using a run of Prime95 for 20 minutes.

VERDICT 7

Fractal Design Kelvin S24

+ **ICEMAN** Easy install; decent performer; expandable.

− **HUMAN TORCH** Noisy fans; poor peak-to-idle performance under OC.

£90, www.fractal-design.com

SPECIFICATIONS

Socket compatibility	Intel and AMD
Water block	Pure copper
Fan(s)	2 x 120mm
Radiator dimensions (L x W x H)	275 x 124 x 30mm
Warranty	Two years

Mr TKL is a compact, robust gaming keyboard missing a few essentials.

Roccat Ryos TKL Pro

A compact mech board for the number-phobic gamer

WE'RE REALLY TRYING HARD not to be too cynical about the Ryos TKL Pro, but Roccat hasn't made it easy. It's a cut-down version of the full-fat Ryos MK Pro, just £10 cheaper, but you lose a hell of a lot in the switch. And we're not just talking about the absent numpad either.

Essentially that's what the TKL stands for in the name – tenkeyless. And by the 10 keys we assume that refers to the 0 to 9 keys on the missing numpad, and not the seven other keys which traditionally orbit those numerals. That makes this board a compact design, laid out specifically for gamers, and notably FPS gamers at that. Roccat claims the fact there's less distance between a gamer's mouse and keyboard hands is "perfect for those who game optimally when there's less space between their wrists". We're guessing that's a gaming niche we were previously unaware of and somewhat ironic given the board's name puts us immediately in mind of a professional Mr Tickle.

Unlike some other compact designs you still get the cursor keys and the nine control keys above them, so you're not really losing out much in the traditional keyboard stakes. Granted there will definitely be some gamers who can't abide by compact boards, feeling utterly lost without the numpad. But if you're perennially finding your gaming claws bent around your mouse in one hand and contorted across the WSAD keys with the other, you're unlikely to miss it.

Like its big Ryos brother, the TKL Pro is a full mechanical keyboard with N-key rollover to count every single keypress no matter how much you faceroll your board. As is the way with most modern mech switch boards, you have the full range of Cherry MX keys at your disposal. Our review board is rocking the brown switches, but you can also pick up reds, blues and blacks as well.

For the uninitiated, the browns have a tangible actuation point, which can feel a little gritty. Blues are the same but also have an audible click for that old school typewriter soundscape. The red and black switches are both linear switches, with no tactile or audible actuation point, but the blacks are a little stiffer, requiring more force to depress.

ESSENTIAL DESELECTION

Also like the larger Ryos, you get per-key blue LED lighting which can be played with to add some superfluous, but admittedly pleasing, effects. You also get the full Roccat range of gaming goodies, such as the Easy-Shift[+] button, which can turn any key into a macro, plus the three programmable buttons beneath the Spacebar – again perfectly placed for the FPS gamer.

Which all sounds grand. A full mech-switch board, all the Roccat extras and some nifty lighting effects sans numpad. But that's not the full story. If it was we'd be happily scoring the tickle pro higher. Sadly, it looks like Roccat is concerned with not cannibalising sales of the slightly more expensive MK Pro because not only do you lose the numpad, you also miss out on the audio I/O and USB pass-through too. On a gaming board we'd say those are almost essential requirements. We recently castigated the Corsair K70 RGB for also lacking them.

Given how expensive the Pro is, losing those two key features is unforgivable. Added together with the lack of dedicated volume and media controls makes this otherwise robust and powerful mech switch gaming board seem like conspicuously poor value. **–DAVE JAMES**

VERDICT 7

Roccat Ryos TKL Pro

MR TICKLE Solid mech switch board; so many potential macros; per-key lighting.

MR MEAN Expensive; lacks USB pass-through; no audio I/O; no dedicated media controls.

£120, ww.roccat.org

SPECIFICATIONS

Response time	1ms
Programmable keys	91
Cable length	1.8m
MCU	2x 32-bit ARM Cortex
Flash memory	2MB

Both the R5's two main drive cages are removable.

Fractal Design Define R5

A defining moment? The successor to a classic has arrived

IT'S AROUND TWO YEARS SINCE Swedish case designers Fractal Design launched the highly successful Define R4 case. And now we have its successor – the succinct Define R5. At first glance the new case looks pretty much the same as its predecessor, which is no bad thing. But as they say, the devil is in the detail and with the R5, Old Nick has certainly been busy.

The front door now has the option to be hinged on either side, a very useful update. The top of the case has three ModuVents fitted. Each of the three pop-out panels have a sound-proofed lining and cover the top of the case. They're ideal for building a quiet PC, but should the need arise for extra cooling then it's just a matter of fitting a fan or three in the roof and popping out the panel(s). The main side panel now has a locking latch as well as thumbscrews for extra security and the bottom dust filter has had a bit of a tweak. It now runs very nearly the length of the case and, with longer rails, it's easier to get in and out. The fact you can now pull it out from the front also gets a thumbs up.

TRAY IMPRESSIVE

There are plenty of drive options with the case. And then some. The R5 has two internal drive cages, the top one supporting five bays, the bottom one three. Each drive bay tray supports either 3.5 or 2.5-inch drives with rubber mounting grommets for 3.5-inch drives. Should you just want to use SSDs then there are two dedicated trays on the rear of the motherboard tray. The downside to all of these drive mounts is that you need a screwdriver to fix any drives in place.

But now the clever bit. The two main drive cages and the two optical bays for that matter are all removable and the cages can be fixed in a number of places to give much more freedom in how the internals are laid out in regards to cooling radiators, long graphics cards and so on.

Fractal has designed the case to be as quiet as possible and to this end has fitted some good quality sound-absorbing materials to the front door and both side panels, plus fitted a pair of its own Dynamic GP14 140mm fans (one in the rear panel and one behind the front bezel). Should you feel the need for more cooling there are mounts for another seven – yes, seven – 120/140mm fans.

COOL CUSTOMER

And it doesn't stop there. There's also a multitude of supports for liquid cooling. The roof can support radiators up to 420mm (with a 55mm limit on thickness), while behind the front bezel there's room for radiators up to 360mm (but the drive bays have to be moved). A 120 or 240mm radiator can be installed in the base but this does mean compromising on the length of the PSU. Finally the rear panel can support a 120 or 140mm radiator.

Fractal has even put some thought into something as mundane as the accessory box. It hasn't just chucked all the screws in a plastic bag, oh no. Each individual group is in its own bag so it's really easy to identify them with the aid of the very good user guide. Some 30 pages long, the guide tells you where everything is or goes with the aid of clearly drawn diagrams. It knocks most other case manuals into a cocked hat. –**SIMON CRISP**

VERDICT
8

Fractal Design Define R5

➕ **HIGH FIVE** Flexible storage options; dedicated SSD mounts; superb manual.

➖ **LEFT HANGING** Drive bays need a screwdriver; fan controller only supports three fans.

£86, www.fractal-design.com

SPECIFICATIONS

Motherboard support	ATX, mATX, M-ITX
Dimensions (W x H x D)	327 x 615 x 540mm
CPU cooler max height	180mm
Graphics card max length	Up to 440mm (with drive cage removed)
Storage support	2x 5.25in, 8x 3.5in/2.5in, 2x 2.5in dedicated

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Gigabyte BRIX S

Why, hello Mr Broadwell…

GIGABYTE
intel inside CORE i5

A sleek, small, but surprisingly mighty machine. For a price.

SPECIFICATIONS

SKU	GB-BXi5H-5200
CPU	Intel Core i5-5200U @ 2.5GHz
Memory	Up to 16GB DDR3L SO-DIMM
Storage	1x 2.5-inch, 1x mSATA
Network	802.11 ac WiFi card, Gigabit LAN
Video	1x HDMI, 1x mini DP
I/O	4x USB 3.0, 1x 3.5mm headphone/mic
Dimensions	46.8 x 107.6 x 114.4mm

HOLD UP, HOLD UP. We know this is essentially a desktop machine and, yes, it has a Broadwell i5 processor in there, but this doesn't mean that Intel's newest CPU generation has actually made its way out of the low-power, mobile mindset. Gigabyte's latest BRIX S *is* rocking a new fifth-generation Core processor, but this is from the mobile U-series that Intel launched at January's CES.

The Core i5-5200U is a dual-core Broadwell chip with a TDP of just 15W, making it a great chip to fit inside a mini PC like Gigabyte's BRIX S. Despite that lowly TDP, you're still getting an impressive amount of performance from this wee chip – it may be dual-core but thanks to the magic of Hyperthreading you do get that split out into four threads of processing power. It's not going to be winning any medals for top frequency, but at a steady 2.5GHz, the 5200U manages a decent rate of knots considering its low-power status. The processor is rated to Turbo up to 2.7GHz, but testing just the single-threaded performance didn't help us raise those extra 200MHz of Turbo power.

NEW ARCHITECTURE

Not that it matters – this isn't some workstation monster. You're not going to expect the BRIX S to breeze through heavy rendering, extreme mathematics or calculate the answer to the ultimate question. This is a tiny, fully fledged x86 PC that you could lose down the back of your TV if it wasn't bolted down. It's probably for that exact reason Gigabyte has included a VESA mounting bracket in the package; there's little more annoying than having your PC disappear down a crack in your furniture or spotting your cat carrying it off to bury in their litter tray.

What does Broadwell in this guise get us then? After all, the previous i5-powered BRIX was rocking a Haswell 4200U CPU with the same chilled-out 15W TDP. Unsurprisingly for a die-shrinking Intel Tick, not a huge amount has actually changed with the processor itself in the switch from Haswell to Broadwell. The CPU architecture remains as with Haswell, except with the teeniest transistors now being cut down into a 14nm lithography. That shrink allows the i5-5200U to maintain the same TDP but with a dramatically improved base clockspeed. This i5 runs at 2.2GHz as standard while the ol' Haswell chip has a far more sedate 1.6GHz base.

But, as this is ostensibly a Tick+ in Intel parlance, the graphics side of the equation has had rather more attention. Intel has improved the geometry and tessellation hardware in Broadwell's HD Graphics and the HD 5500 revision in the BRIX S gets you an extra four execution units (EUs). What all that means is you're almost getting Haswell Iris Pro levels of gaming performance from this low-power part and that's a CPU with 40 EUs. We can't wait to see what Broadwell Iris Pro can do with 48 of these new EUs.

Admittedly that gaming prowess was when this barebones BRIX S was kitted out with 16GB of DDR3L running at 1,600MHz, but it's still a pretty impressive feat for this li'l box of delights. Dial things down in the graphics settings and drop to 720p and you'll be capable of some decent gaming on this box. It will also nail Steam's In-Home Streaming, though even the older, more basic BRIX could do that.

NOT-SO-MINI PRICE

The issue though is that it's still hugely expensive to put a decent BRIX S machine together. This barebones setup is some £310 – that gets you the wee chassis, fitted out with the motherboard and chip soldered onto it. You also get the wireless card attached, four USB 3.0 ports and a Gigabit Ethernet connection too. But you'll have to source your storage, memory and OS yourself – the high-end spec of our review unit would have pushed the price up to around £700.

That makes the BRIX S a tough one to recommend. The form factor is a delight and the 15W TDP means the diminutive cooling array can remain almost silent even when it's running at full tilt. The new Broadwell CPU also means that it never feels like anything other than a proper desktop PC in use – it's quick, slick and responsive. But when you're paying the sort of price that would net you a laptop with the same CPU and spec, it starts to make the BRIX look a little short on versatility by comparison.

–DAVE JAMES

BENCHMARKS

	Gigabyte BRIX	MSI GS30
Cinebench R15	259	**612**
X264 v4.0	16.18	**35.24**
Heaven (min/avg fps)	3.2/5.1	**3.6/5.9**
Bioshock Infinite (min/avg fps)	4/7	2/9
GRID 2 (min/avg fps)	13/13	**13/18**

Best scores are bolded. The graphics benchmarks were run at their highest settings, with 4x AA running at 1080p. Punishing, we know... The GS30 is running a Haswell Iris Pro CPU for comparison.

VERDICT
8

Gigabyte BRIX S

+ **BRIX** Tiny; practically silent; responsive; decent integrated GPU performance.

− **DUPLO** Expensive to fully kit out.

£310 (barebones), www.gigabyte.com

RIG BUILDER

BY DAVE JAMES

Build Your Perfect PC

Whether you're upgrading your PC or starting anew, this is the best kit

ONE OF THE JOYS OF OWNING A PC is that you can upgrade it as you go. Need higher frame rates in games? Drop in a newer graphics card. Want more power elsewhere? Grab a new processor or go for that old favourite: the memory boost. There's a wealth of upgrades that can transform your machine, plus you can change slowly over time to suit your budget, so you rarely have to suffer a sluggish rig for long. Every now and then, the best possible upgrade is to dump your current rig and start afresh by building a whole new machine from scratch.

What sort of machine should you build, though? Which items are important? Which work well together? How much should you be budgeting for? That's a lot of questions, and getting the right answers means having to go and research all the current trends in order to make the best decision. Before you do that, though, take a look at our guide. You'll discover that we've taken the hard work out of the equation and presented you with three machines that fit three different budgets. Our budget PC will get you gaming at 1080p for a bargain price, our mainstream machine will cope with pretty much anything at 1440p, and our high-end rig will do pretty much whatever it wants...

On these pages are our recommendations for putting together those budget, mainstream and silly high-end machines. These rigs all include a screen and peripherals in the ticket price, so if you're keeping your existing goodies then you'll have more cash to spend elsewhere. And what's our recommendation if you find yourself with that pleasant problem? Either get a larger SSD or a more powerful GPU. Happy building you lovely people!

HOW TO... BUY A MOUSE

PICKING THE PERFECT GAMING MOUSE is such an inherently personal choice it's actually really hard to be able to recommend the de facto 'best mouse'. So much of what makes the perfect mouse for you is how it sits in your hand and, because all our hands are different sizes and shapes, that's tough for any one person to determine.

Then there's how you actually control the mouse too. There are generally two schools of mouse grip – the claws and the palmers. One likes to hold the mouse by the tips of the fingers for greater fine grain control and the other uses the entire hand, using more sweeping gestures. So, we'd recommend where possible physically seeing how a mouse sits in your own hand before buying. Head out to your local bricks and mortar store and see if you can get a feel for them.

It's these physical comfort factors that will arguably matter more in the long run than high DPI settings.

BUDGET

MOTHERBOARD	
MSI B85M-E45	£48
CPU	
Intel Pentium G3258	£53
MEMORY	
Crucial 2x 2GB DDR3 1,600MHz	£31
GRAPHICS CARD	
MSI GTX 750 Ti OC	£111
SOLID-STATE DRIVE	
OCZ ARC 100 240GB	£75
CPU COOLER	
Intel Stock Cooler	N/A
POWER SUPPLY	
SilverStone Strider E 500W	£39
CHASSIS	
Corsair Carbide 200R	£48
OPTICAL DRIVE	
LiteOn IHAS124-14 24x DVD±RW	£10
SCREEN	
AOC E2250SWDNK	£80
TOTAL	**£495**

MAINSTREAM

MOTHERBOARD	
Asus Z97-A	£115
CPU	
Intel Core i5-4690K	£190
MEMORY	
Corsair Vengeance LP 8GB	£60
GRAPHICS CARD	
Sapphire R9 285	£176
SOLID-STATE DRIVE	
Crucial MX100 512GB	£152
CPU COOLER	
Enermax ETS-T40	£30
POWER SUPPLY	
OCZ ModXStream Pro	£64
CHASSIS	
Cooler Master CM690 II	£68
KEYBOARD	
Corsair Vengeance K65	£65
SCREEN	
Viewsonic VX2363Smhl	£129
TOTAL	**£1,049**

HIGH-END

MOTHERBOARD	
Asus X99 Deluxe	£295
CPU	
Intel Core i7-5960X	£800
MEMORY	
Corsair Vengeance LPX 16GB	£202
GRAPHICS CARD	
MSI R9 295X2	£680
SOLID-STATE DRIVE	
Samsung 850 EVO 1TB	£332
CPU COOLER	
Cooler Master Nepton 240M	£86
POWER SUPPLY	
CM Silent Pro Gold 1,000W	£120
CHASSIS	
CM Cosmos 2 Ultra	£280
KEYBOARD	
Corsair Vengeance K70	£112
SCREEN	
Philips BDM4065UC	£614
TOTAL	**£3,521**

BUDGET

When every pound counts, spend them wisely

MOTHERBOARD
MSI B85M-45

With the change in Gigabyte's previously impressive B85M-D2V we've switched to the slightly better MSI board for our budget build.

CPU COOLER
Intel Stock Cooler

The Pentium Anniversary chip is a very cool-running CPU, even when overclocked. We managed a stable 4.2GHz on this stock Intel cooler.

MEMORY
Crucial 4GB 1600 DDR3

Memory pricing continues to be incredibly volatile, but it's still a great time to squeeze more sticks into your rig. You really should see 4GB as the minimum.

CPU
Intel Pentium G3258

Poor AMD, it's a clean sweep for Intel on all our recommended rigs. The new Pentium is simply the best budget chip around right now, offering Haswell for peanuts.

GRAPHICS CARD
MSI GTX 750 Ti OC

Nvidia's latest GPU is quite a feat of engineering because of that brand new Maxwell architecture. The MSI card is a bargain.

SOLID-STATE DRIVE
OCZ ARC 100 240GB

OCZ's ARC 100 drive may not be the quickest, but it's great value, incredibly consistent and quicker than Crucial's MX100 at this capacity.

POWER SUPPLY
SilverStone Strider E

We may be talking about a budget rig here, but it's still a hefty chunk of cash to risk on a no-name power supply. This 500W SilverStone PSU will give you peace of mind and all the PCIe leads you need.

OPTICAL DRIVE
LiteOn IHAS124 DVD+RW

We really wonder whether you actually need an optical drive anymore, but for now we'll err on the side of caution and include one in the list. Don't feel bad if you forget to buy it though.

CHASSIS
Corsair Carbide 200R

Much more impressive than its price tag may lead you to believe, the clean lines and added extras of this chassis make it the budget case to beat. An understated bargain.

SCREEN
AOC E2250SWDNK

This 21.5-inch panel has a native resolution of 1,920 x 1,080 and looks pretty good despite that ridiculously low price tag. It's no IPS-beater, but it'll do for half the cash.

MAINSTREAM

A stunning rig doesn't have to cost a fortune

MOTHERBOARD
Asus Z97-A

We've seen a lot of Z97 motherboards since this Asus offering landed, but nothing newer has managed to push it off this list. Great features at a great price. Simple really.

CPU
Intel Core i5-4690K

For almost the same price as the ol' 4670K you can pick up one of the newer Devil's Canyon CPUs. It's only got a 100MHz clock boost, but the new TIM helps with overclocking.

CPU COOLER
Enermax ETS-T40

Enermax has simply amazed us with this, its first CPU cooler. The performance is excellent, the price is astonishing, it's easy to fit and it isn't so big that it limits your case or mobo choices.

MEMORY
Corsair Vengeance LP 8GB

This pair of 4GB sticks will give you all the performance you could ever want, and they're in stormtrooper white. They'll only take up two slots in the board for upgrading, too.

GRAPHICS CARD
Sapphire R9 285

The newer Tonga Pro GPU in AMD's R9 285 is an impressive wee thing, making it our favourite sub-£200 card. The 2GB frame buffer might be a worry for the hi-res future, but it's a beauty.

SOLID-STATE DRIVE
Crucial MX100 512GB

Crucial has made a big splash in the SSD market with this chunky drive. The 512GB version is quicker, larger and cheaper that the pricier M550.

POWER SUPPLY
OCZ ModXStream Pro

If you want to build a performance machine, you're going to need a powerful PSU. This 500W baby will power the rig, with extra to spare. It's quiet as well.

KEYBOARD
Corsair Vengeance K65

We love a good mechanical switch keyboard here on *PC Format*, and Corsair is making some of the best. The K65 is a great compact option, with a compact price to boot.

CHASSIS
Cooler Master CM690

The CM690 eschews silly gimmicks in favour of producing a no-nonsense chassis that has plenty of cooling options for your mainstream rig. There's space aplenty inside, and all at a reasonable price.

SCREEN
Viewsonic VX2363Smhl

The old 23-inch Viewsonic IPS seems to be EoL now, but this white one has got the budget IPS panel and decent performance for its bargain £129 price tag.

HIGH-END

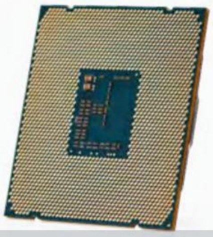
For when you *really* want to treat yourself

MOTHERBOARD
Asus X99 Deluxe

As usual this Deluxe board from Asus is absolutely stuffed with funky features. It's one of the finest, and best-looking, X99 boards around and not a bad overclocker either.

CPU
Intel Core i7-5960X

If you're after the fastest, most advanced CPU around, then this 8-core, 16-thread Haswell-E is it. There is also the 6-core i7-5820K for a more reasonable £300, but the 5960X is the pinnacle of modern CPUs.



CPU COOLER
Cooler Master Nepton 240M

Why settle for a reasonable overclock when you can hit 5GHz? This kit is speedy, boasts incredible performance and is quiet in operation. Everything you'd want, in other words.

MEMORY
Corsair Vengeance 16GB

The Haswell-E platform is the first to bring DDR4 to the consumer. That does come at a hefty price, but it's damned quick.

GRAPHICS CARD
MSI R9 295X2

The dual-GPU R9 295X2 is undeniably the quickest graphics card around. We still worry about these sort of cards, but the liquid-chilling helps those concerns, and besides, it's a beast at 4K.

SOLID-STATE DRIVE
Samsung 850 EVO 1TB

This new spin of the Samsung's 3D NAND means high-capacity is no trouble for its mainstream SSD range. And the 1TB drive has the performance to match its new endurance.

POWER SUPPLY
CM Silent Pro Gold 1000W

Cooler Master continues to impress with its power supply units, and this wonderful box of tricks managed to scoop the gold award in our exacting test way back in PCF246.

KEYBOARD
Corsair Vengeance K70

Corsair's update to the older Vengeance keyboard rights all its older sibling's wrongs. It's also a truly stylish gaming board with the red backlight glowing against its black-brushed metal chassis.

CHASSIS
CM Cosmos 2 Ultra

Cooler Master has always been an impressive maker of cases, but it has truly stunned us with this chassis. Yes, it's expensive, but if you can afford to drop this much on your case, you'll be more than happy.

SCREEN
Philips BDM4065UC

This 40-inch 4K behemoth is the first screen to make us think that super-high resolution actually looks super. It's a decent VA panel and a great price, too, and will really take advantage of the R9 295X2.

Tech Porn

1 INNER SPACE

Pull the front off the Gaming Dock and this is what you'll be presented with. The main bulk of the space is taken up by that MSI GTX 980 Twin Frozr graphics card, plugged into the green daughter board with its x16 PCIe 3.0 adaptor. Also on that verdant slice of PCB is an empty SATA connection to allow you to mount an extra data drive inside the Dock, below the graphics card. The big grey box on the right-hand side is the 450W PSU, which gives juice to not just the GPU, but the laptop too when it's docked up top.

2 EXPRESS
This is what makes all the magic happen. This full x16 PCIe 3.0 connection is what means the docked GTX 980 is able to link up with the top-end Core i7 CPU in the GS30 and can deliver the same level of overall gaming performance in this setup as it does in a traditional desktop gaming rig.

MSI GS30 2M Shadow

OH HOW WE'VE BEEN WAITING FOR THIS TO arrive on our desktops. For many years companies have tried to produce laptop adaptors that will enable you to plug a desktop GPU into your notebook. Many have tried, but MSI has actually succeeded.

The GS30 plugs directly into the x16 PCIe 3.0 connection on top of the dock, with the bundled MSI GTX 980 then taking over all the video and graphical demands of the system. This allows the whole setup to act as a powerful desktop gaming PC and, unlike other manufacturers' attempts at a GPU laptop dock, you get the full power of the connected graphics card. That's the real success of the GS30 bundle, but there is a definite feeling that this is a very first-gen product in need of some overall refinement.

In order to ensure the silicon in the laptop won't be out of date when you eventually come to renew the desktop GPU, MSI has opted for a powerful mobile CPU. That's great in terms of performance, but the cooling necessary for such a chip in this form factor can't help but make a lot of noise. That chip is also largely responsible for the lack of life coming from the four-cell battery it's sporting.

The potential here though is great and we're pleased to finally have proof the desktop GPU adaptor can work flawlessly. We just need that svelte laptop to have a little more life in it. –DAVE JAMES

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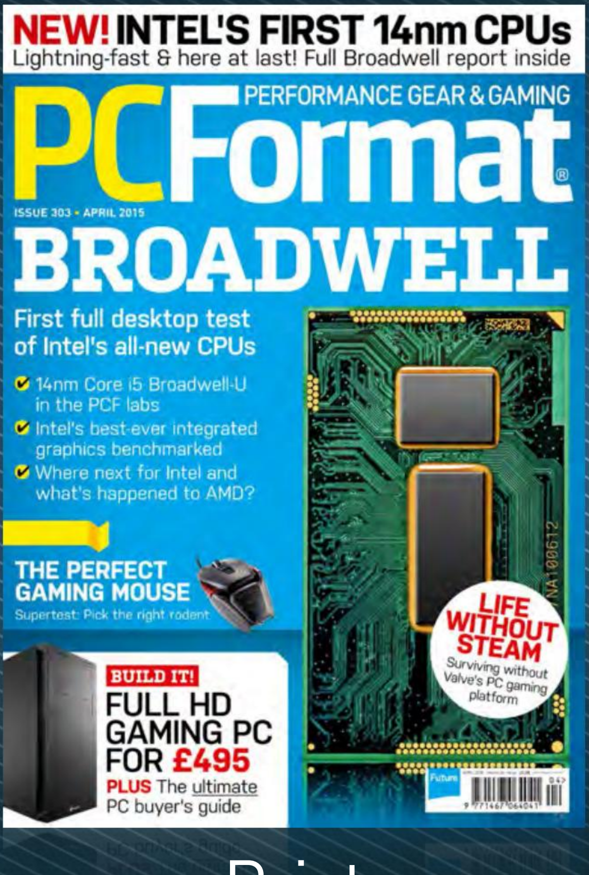
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Broadwell: It's Business Time

An awfully long time coming, Intel's new 14nm CPU family is finally here

BY JEREMY LAIRD

All systems are go with 14nm technology. If there's a single message that Intel wants to hammer into your head with its new family of Broadwell CPUs, it's this: 14nm is on line. Moore's Law lives on.

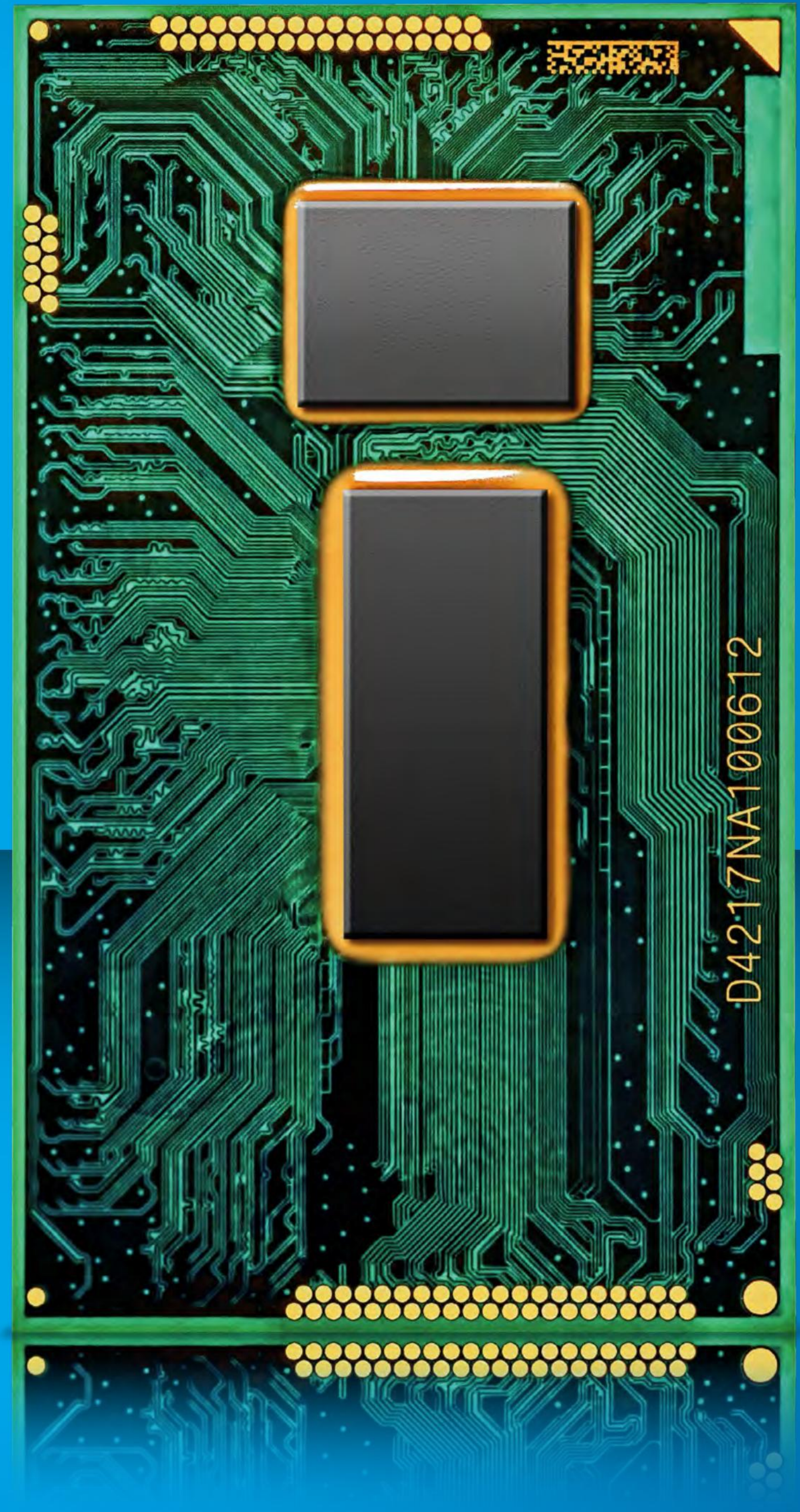
The reality isn't quite so simple. The reality is that Intel has fallen behind its self-imposed schedule of bringing out a new CPU architecture and then a new production process or die shrink in successive years.

As we'll see, as chip features get ever smaller, the production process is becoming one hell of a challenge. As Intel's CPU designs become ever more refined, the new architecture bit ain't all that easy, either. Not if you're expecting substantial gains in performance. That's the context for the new Broadwell family. It's running late. And it's a lot to ask for it to be dramatically better than Intel's already-excellent CPUs. And yet there are reasons to be very glad it's finally arrived.

For starters, thanks to that tricky 14nm tech, Broadwell is by far the most energy efficient architecture Intel has ever created. No, that doesn't automatically translate into epic increases in performance. But it does mean you can have proper PC performance in form factors where it wasn't previously possible. Broadwell also represents yet another big leap in integrated graphics performance. And that begs the age-old question of whether great gaming performance on integrated graphics is finally possible.

On the other hand, Broadwell also reboots our ongoing concerns with Intel's strategy regards the pure-CPU portion of its chips. For some time now, it's felt like Intel has been sandbagging on the CPU side, something that's been made possible thanks to the failure of its main rival, AMD, to offer serious competition.

Broadwell's lateness is also creating confusion in the context of the anticipated arrival of its successor, known as Skylake. As we go to press, Intel hasn't actually announced full details of the desktop Broadwell range. But we're expecting Skylake, including desktop derivatives, to arrive in the second half of this year. It's all a bit baffling. So let's start to make sense of Intel's 14nm mess.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The wait is over. Broadwell is here at last.

Something has gone wrong at Intel. It was back in June 2013 that we first got our hands on desktop variants of Intel's Haswell family of CPUs. Now here we are roughly two years later and Intel has yet to announce desktop Broadwell processors.

Meanwhile the successor to Broadwell, an all-new architecture known as Skylake, is due later this year. For a company famed for its well-oiled and accurate execution of new product launches, of late at least, it's all a bit untidy.

It also makes a mockery of protestations from Intel that it's "on track for a healthy 14nm ramp". Undoubtedly and undeniably, 14nm has been problematical for Intel. But then the entire chip industry is increasingly struggling to keep Moore's Law on line. Not that we should be surprised by that – current chip technology is fast approaching a tiny thing that's going to be a big problem. The size of the atom. (See "No More Moore" on page 58.)

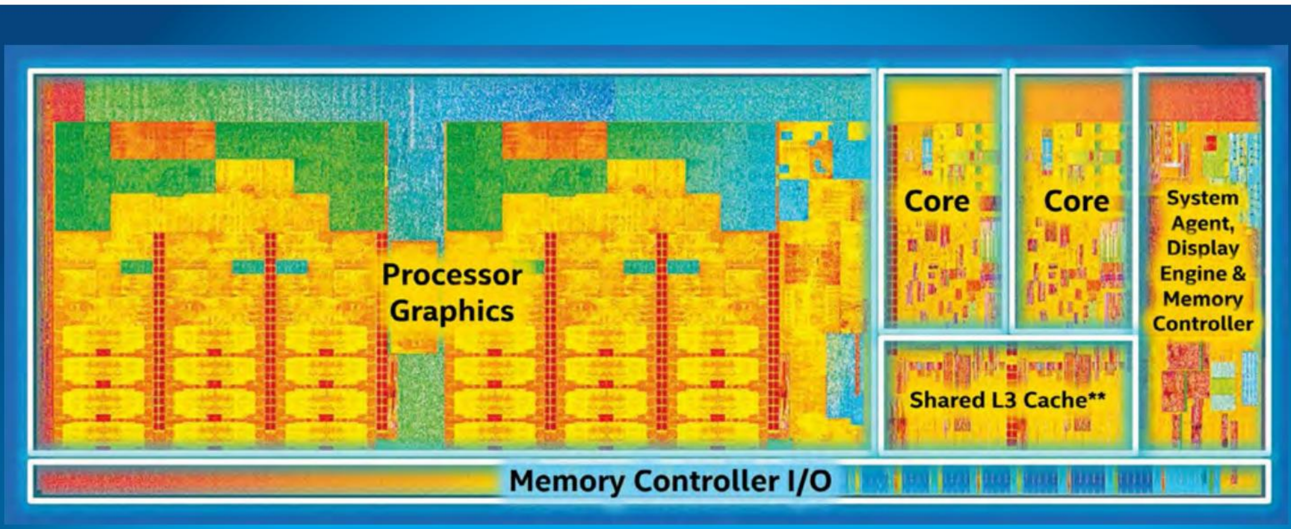
Anyway, Broadwell really ought to have been available in full back in 2014. As it is, Intel only managed a trickle of dual-core mobile models late last year. At the same time, Intel says it's sticking to its original plan of rolling out Skylake later this year. All of which begs two questions. What does Broadwell have to offer and is there any point to it for PC enthusiasts? Cue the Intel marketing machine.

If you want the classic elevator pitch for Broadwell, it goes something like this: Broadwell is Intel's fifth-generation Core processor. It's the first Intel chip to be built on 14nm process technology and offers the smallest chip features ever. It's much more efficient, with better battery life, and you get much faster graphics. Conspicuously absent from the pitch are big claims regards the CPU subsystem of the new chips. Hold that thought though, we'll come back to it shortly.

Broadwell's first foray onto the desktop, still in mobile clothing.

PRODUCTIVITY PLUS?

First, let's knock about a few numbers that get to the heart of what Broadwell is about. Unfortunately, Intel has yet to release proper numbers or even model names for any desktop Broadwells, or even quad-core mobile Broadwells. So the best data available relates to dual-core mobile chips. We'll compare the new Core i7-5600U with its direct predecessor, the i7-4600U. It's a high-end dual-core model with the biggest available graphics subsystem. It packs 35 per cent more transistors than before



THE CORE OF THE PROBLEM

The future's bright. The future's massively multicore...

So went the Intel PR pitch at multiple installments of its IDF techfest. Today two cores, tomorrow four, in years to come more than you could count.

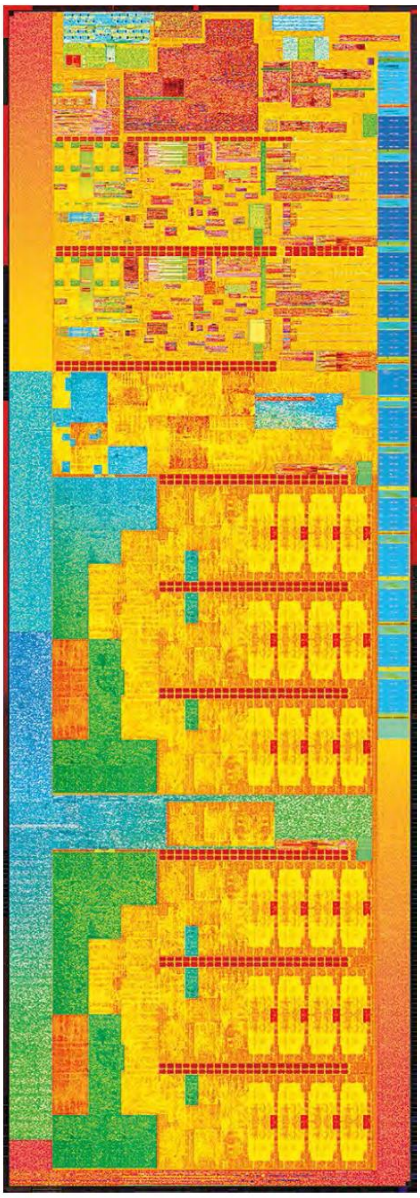
Recently? Not so much. That's reflected in the fact Intel's mainstream processors still only have four cores, nearly nine years after its first quad-core CPUs were announced. So, what the hell happened?

There are two ways to look at this. Firstly, Intel is making CPUs with loads of cores, it's just not putting them into PCs. Want a CPU with 18 cores? Intel makes one for servers, albeit costing thousands. At best you can have an eight-core CPU in the high-end LGA2011 platform which is really just rebadged server technology.

You could also argue that those cores have migrated to graphics. All of Intel's mainstream CPUs now have integrated graphics and if you take a peak at, say, the die shot of a dual-core chip with the big graphics core, it's at least two-thirds graphics. A quad-core model would be roughly 50/50. And, of course, that big graphics 'core' has 48 execution units, which you could style as cores – suddenly you've got a 52-core chip.

Indeed, that graphics part of the chip can be used for some workloads that are traditionally CPU fare, such as video encoding. The problem with that view is that if you care about gaming, it's pretty much irrelevant. You'll have a proper discreet GPU and the gunk Intel integrates onto its CPU simply doesn't factor. That includes Broadwell's beefed-up graphics, as good as it is by integrated standards.

No, however you slice it, Intel's mainstream CPUs are still four cores. Nearly a decade on, that's disappointing.



The first flush of Broadwell is all dual-core.

at 1.9 billion, and yet the new 14nm process means it's also 37 per cent smaller in terms of die size.

Its graphics is claimed to be 22 per cent faster than the 4600U, hardware accelerated video encoding is a remarkable 50 per cent faster and battery life goes up by around 1.5 hours. Impressive. Less wonderful are the numbers relating to what you might call pure CPU performance. Intel is only claiming a 4 per cent improvement in productivity performance.

There are several reasons for that. Firstly, Intel's x86 CPU cores are now very finely honed indeed. The low-hanging fruit in terms of performance optimisations were ripped from the tree long ago. If there's anything left dangling, it's just some very small stragglers on the hardest-to-reach branches.

What's more, Intel has reduced the maximum Turbo frequency of the 5600U by 100MHz to 3.2GHz. So that modest 4 per cent gain is actually achieved at a lower peak operating speed. However, while the top Turbo speed is down a little, the base frequency is up by a hefty 500MHz to 2.6GHz. That should help in terms of sustained performance in thin and light laptops where heat can build up and prevent you from accessing the Turbo function. In that scenario, we reckon the 5600U might well be 20 per cent quicker for CPU tasks than the old 4600U.

Of course, we also need to remember that Broadwell is a Tick in Intel's Tick-Tock chip development parlance. That means it's all about the die shrink from 22nm to 14nm; it's not meant to bring a dramatically new architecture. That said, Broadwell is being styled as a Tick-plus, and thus more than a simple die shrink. But the 'plus' bit is more about graphics and other features. In most regards, the CPU cores are carried over.

Anyway, that extra 1.5 hours of battery life is a big deal. It reflects an overall efficiency boost that will allow proper PC performance to be squeezed into yet smaller form factors. At this point in the Broadwell product cycle, it's early days. Just keep your scanners peeled for ridiculously thin and light notebooks as well as just possibly some interesting tablets. We'd certainly love to see a Microsoft Surface with the most powerful Broadwell graphics options.

> "Keep your scanners peeled for some ridiculously thin and light notebooks and possibly some interesting tablets."

GRAPHICS GRUNT

While we're on the subject, what of the new graphics technology in Broadwell? Power efficiency aside, it's got to be the most interesting aspect of the new architecture. In fact, it's the latest in a long line of improved integrated graphics from Intel in recent years. Intel claims Broadwell represents a 100-fold increase in integrated graphics performance since 2006.

That sounds like an astonishing leap. However, the starting point in 2006 was so very low that the 100x metric doesn't actually mean much. No, what really matters isn't how much faster Broadwell graphics is compared to something ancient and absolutely awful. What matters is whether you can really game on it.

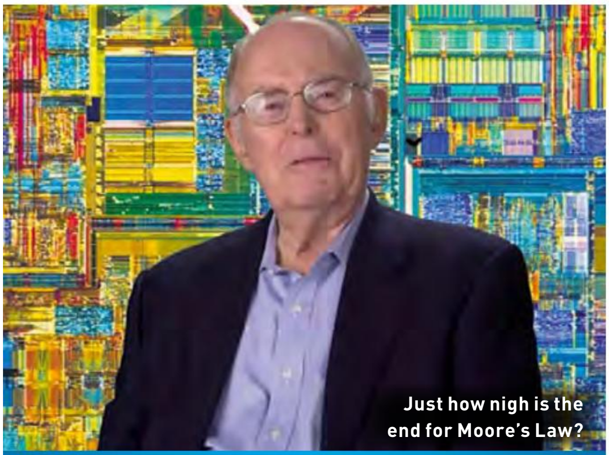
On paper, the changes for Broadwell do not seem hugely dramatic. The basic graphics core gets a bump from 20 execution units to 24 and the fastest configuration goes from 40 to 48 units. Then you note that Broadwell graphics are a continuation of Intel's so-called Gen7 graphics architecture from Haswell and previous families of chips. And you might conclude we're looking at worthwhile improvements, no doubt, but hardly the stuff of 100-fold leaps in gaming performance.

Broadwell's graphics revamp is far greater than it seems at first.

But that wouldn't be entirely fair. Intel has given Gen7 a pretty hefty overhaul for Broadwell. It goes well beyond simply throwing a few more execution units at the problem of faster frame rates. For starters, Broadwell has been updated to support the latest graphics APIs. That specifically means Direct3D 11_2 now and support for Direct3D 12 (often simply referred to via the multimedia super set API that is DirectX 12) when it arrives with the final retail build of Windows 10.

Intel has also confirmed that Broadwell graphics is OpenCL 2.0 compliant, including shared virtual memory. So it really is a thoroughly modern graphics design and, for what it's worth, has all the general-purpose computing bells and whistles, too.

But it's the structure of the rendering pipeline where things get more interesting for we gaming addicts. Intel's graphics cores are subdivided into what you might call


Just how nigh is the end for Moore's Law?

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NO MORE MOORE?

The days of shrinking chips enter final decade or so as size of the atom rushes into view

Moore's Law is the observation, first noted by Intel co-founder Gordon Moore way back in the 1960s, that transistor density in computer chips tend to double every couple of years.

Put another way, it means the complexity and power a computer chip of a given size doubles every two years. That, of course, gives rise to an exponential explosion in computing power over an extended time frame. Two becomes four and then eight, 16, 32, 64, 128 and so on. That's why today's desktop computers sport terraflops of raw compute power and why smartphones are faster than yesteryear's PCs.

But for how much longer? A bit like constant prognostications that fossil fuels will run out any day now, you could say reports of the demise of Moore's Law have been greatly exaggerated over the years. And yet with both oil and Moore's Law, it can't go on forever. One day the oil *will* run out. And one day Moore's Law *will* hit the wall.

With oil, it's hard to say exactly when. Nobody really knows how much oil is left in the ground. For existing chip technology, it's a little easier. The width of the atoms used in current chip production are roughly 0.2nm. The smallest atoms are hydrogen and they rock in at about 0.1nm. Today, Intel is selling processors with 14nm features. Immediately, then, there are hard, physical limits to how small you can make the transistors or gates within chips.

That doesn't necessarily limit the progression of computing per se. But at the very least we'll need a new paradigm, be that quantum computing or something else. Indeed, there are clear signs that the computer chip industry is already struggling to keep Moore's Law on track as feature sizes bear down on that final limitation – the size of an atom.

IBM recently gave up making chips, for instance, and the cost of the facilities or foundaries for chip making are rising in an exponential fashion that almost matches the increasing power of the computers they enable. There's at least a decade of further progress available. But after that, it really can't go on too much longer.

'slices'. For Haswell, each slice had 10 execution units. For Broadwell, this actually drops to eight.

If that sounds like a step backwards, the point is that each slice has shared resources in terms of cache memory and sampler units. With few execution units per slice, you get more cache and more sampling for each execution. Individual sampler performance has also been increased, the upshot of which is a 50 per cent bump in overall sampler performance. Intel has also tweaked the ROPs, or render outputs, and rasterisers to increase fill rates.

LUCK OF THE IRIS

The upshot of all of this is that the new mid-sized graphics core with 24 execution units, known as GT2, has nearly closed the gap with the old big graphics core, known as GT3, in Haswell. You can read the full details on page 44, in our review of the new Gigabyte Brix S, with its Broadwell-U Core i5 5500-U chip. But in both *Bioshock* and *GRID 2*, Broadwell GT2 is remarkably close to Haswell GT3.

What it's not, however, is what we'd really call fully gameable. In both games, average frame rates at 1080p and full detail with 4x anti-aliasing enabled are well below 30 frames per second. Even if you double the frame rates for the 48-unit Broadwell GT3, which we haven't tested yet, and add a bit for the eDRAM memory that comes with the very fastest version, known as Iris Pro, we're still talking marginal frame rates at 1080p in what are not exactly the most demanding games out there.

Actually, while we're talking Iris Pro, it's worth noting that both Intel's baffling branding and its awkward positioning of its GPU technology looks like remaining with Broadwell. On the branding side, Intel is keeping the HD Graphics and Iris split. What's confusing is that Broadwell CPUs with the fastest HD Graphics 6000 solutions will get the 48-unit core, just like Iris 6100 and Iris Pro 6200 graphics. To us it would be easier for everyone to understand what they're buying if the 48-unit graphics was exclusively branded Iris.

As for the positioning, the problem has been that Intel has tended to restrict its fastest graphics to its higher-end CPU configurations. And that doesn't actually make any sense, especially on the desktop, but even in laptops. That's because any system with an expensive, relatively high-end quad-core CPU is going to have a discrete or plug-in video card of some kind, making the specification of the integrated graphics essentially irrelevant.

Instead, it would would make much more sense to have a cheap dual-core CPU paired with the quickest graphics configuration and end up with something capable of a bit of light gaming for not all that much money. At least, it would make much more sense for us poor gamers and computing junkies. The problem is that big graphics means big computer chip.

Intel does do a dual-core chip with the big 48-unit graphics core for laptops, but you only have to glance at the die shot on page 56 to understand the problem. The graphics portion of the chip is huge. It's at least two-thirds of the chip, maybe more. The consequence is a mere dual-core PC processor with nearly two billions transistors.

Even taking into account the savings that come with a die shrink to 14nm, that pushes up the production cost and makes it

Gesture-recognising laptops with Intel's RealSense.

tricky to sell a low-end model with the highest performing graphics. Eventually, graphics and CPU functionality will probably cease to be in any way distinct and the problem will disappear. For now, it means we can't quite have the precise configurations we'd prefer.

REALSENSE AND SENSIBILITY

If efficiency and graphics are the big deals, is there anything else to get excited about? Intel is talking up "enhanced capabilities" for Broadwell and they fall into a few categories. The first you might call more "natural" interactions.

According to the Intel spiel, with the PC we've gone from plain old text input to graphical user interfaces and then touchscreens and voice control. What's next? Adding senses to the PC, namely the ability to recognise gestures and facial expressions along with more natural language recognition. Now this isn't really a feature of a Broadwell CPU, but it does require processing power. And if you're going to have that processing power available in today's increasingly mobile form factors, you need the improved efficiency that Broadwell brings.

Intel is actually getting into this game itself with its own technology, known as Intel RealSense. The feature set is based around 3D-capable sensors. There's a conventional colour camera in the centre, flanked on one side by an IR laser projector

Intel's Jarvis headset aims to take on Siri and Cortana.

Intel's wireless display technology, WiDi v5.1, promises lower latency than ever.

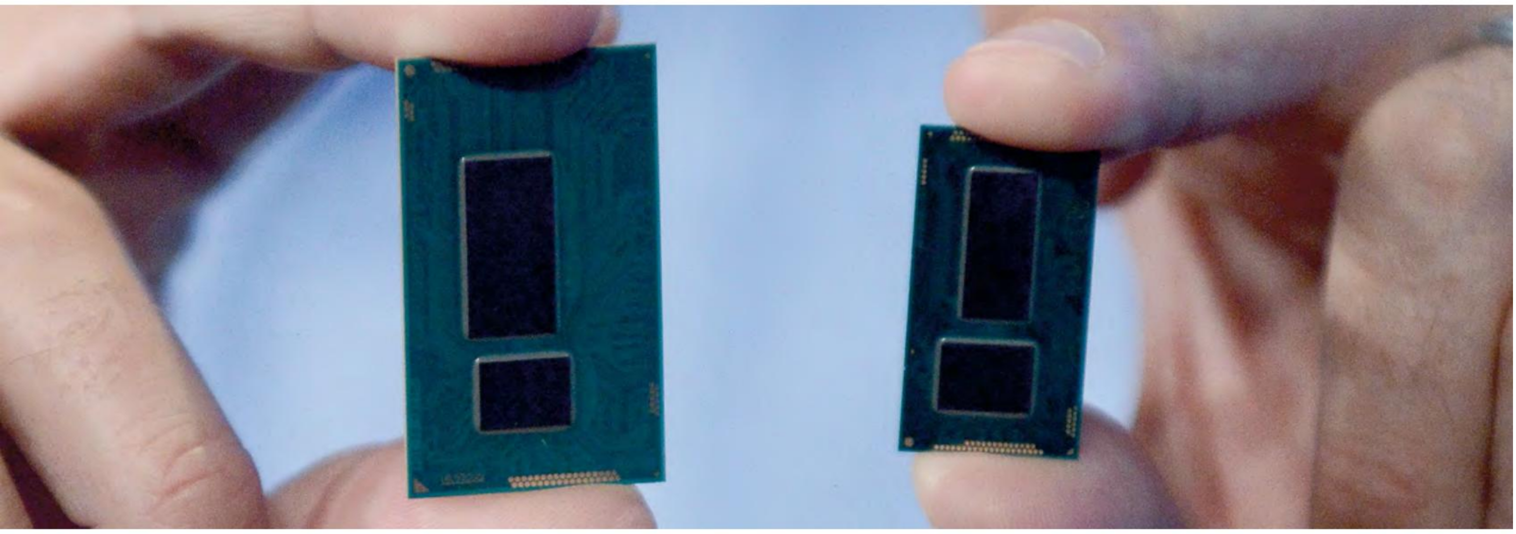
BROADWELL FACTFEST

In our quest to dive deep into the architectural nether regions of a new CPU family, it's sometimes easy to miss out on some fun little factoids, so here you go…

First, Broadwell is a proper 4K chip. No, not for gaming. Even Nvidia and AMD's finest dedicated GPUs struggle with that. No, we're talking 4K video displays and video decode. Broadwell has H.265 and VP9 4K decode capability and can output at 4K 60Hz assuming motherboard support. Which is nice.

While we're talking displays, Broadwell coincides with an update to Intel's wireless display technology known as WiDi. Version 5.1 is said to tout full gaming support, for which read lower latency than ever. To be frank, we'll want to try that for ourselves. Intel has also added a WiDi remote for easy dual-screen management. But here's the really interesting bit. WiDi now supports 4K. Again, this is something we really want to see first hand before getting too excited. It's the sort of thing that could be incredible. Or it could be a feature that looks great on paper, but requires such perfect signal integrity that it barely ever actually works. Still, you can get a WiDi v5.1 adaptor for your TV for under £35, so it's certainly not expensive technology.

And finally… did you know that Broadwell chips will be going into Chromebooks as well as Windows laptops? As Windows comes under more pressure from Apple's iOS, and Google's Chrome and Android operating systems, Intel is increasingly in favour of finding ways for its chips to work with a broader range of software. With Chrome apps and features increasingly offering an offline mode, having proper CPU power in a Chromebook could prove ever more worthwhile.



Haswell versus Broadwell – the difference a die-shrink makes.

DARE WE ASK ABOUT AMD?

Intel's only rival in the PC processor market continues to strive, and struggle, to keep up with the advances

Every time you think AMD is about to drop dead, some good news pops up. But you can be just as sure that any time things are looking up, some disaster or other lies just around the corner.

So where does that put AMD today? The context here is Intel's ceaseless march of technology. While we nitpick over its delayed 14nm technology, there's no denying Intel has broadly stuck to its Tick-Tock strategy of releasing new CPU architectures and new production processes in alternating years.

AMD, meanwhile, simply doesn't seem able to react. Its current performance CPUs are based on the Bulldozer architecture that first appeared in 2011 and was supposed to take the fight to Intel's Core. It's been slightly revised on a few occasions since. But there's no getting round it – Bulldozer is a failure. In fact, we'd say it's so bad that AMD would've been better off developing the Hammer CPU core that dates back to 2003 and was launched under the Athlon 64 branding.

AMD currently has little to excite PC enthusiasts or gamers. It's been pegged back to chips that just about make sense on account of being cheap. That means tight margins and narrow profits. Not good. But is there any hope of a turnaround?

Enter Zen, its all-new x86 CPU architecture. Due out in 2016 – though if AMD's past form is anything to go by it'll more likely than not miss that target – few details are currently known. However, the weight of opinion and rumour points to a launch on 14nm production technology, compatibility with AMD's FM3 socket and support for both DDR4 memory and PCI Express 3.0 interconnects.

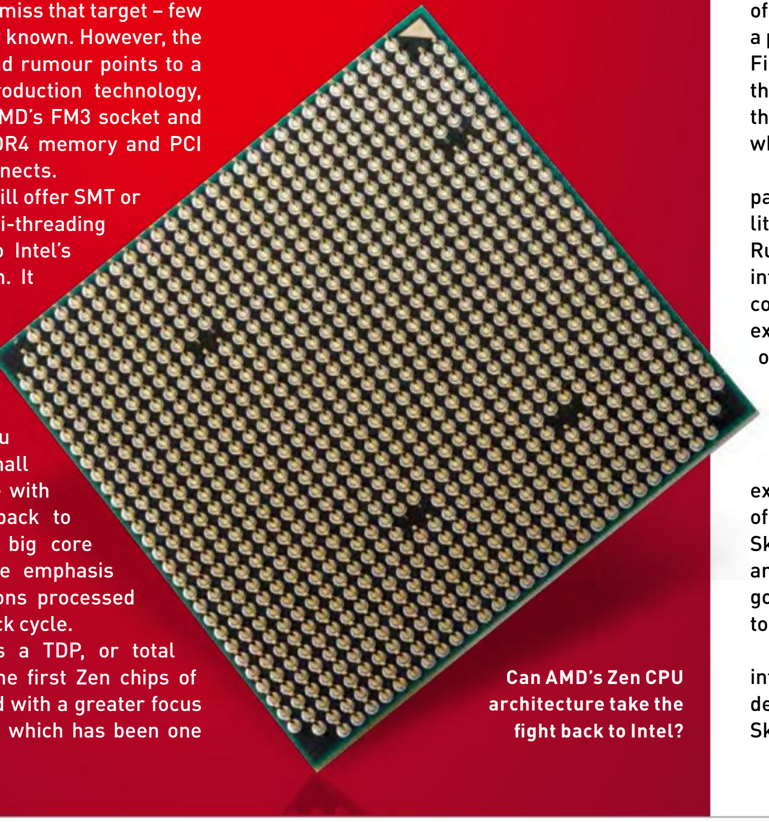
It's thought Zen will offer SMT or simultaneous multi-threading capability similar to Intel's Hyperthreading tech. It will also likely be a step away from the modular architecture of Bulldozer with its pairing of what you might call two small cores into a module with shared resources back to a more traditional big core approach with more emphasis on IPC or instructions processed per core and per clock cycle.

Another detail is a TDP, or total design power, for the first Zen chips of up to 95W, combined with a greater focus on power efficiency, which has been one of Bulldozer's most conspicuous failings. Taken together, the combination of 95W TDP and increased efficiency confirms that AMD intends to compete at the performance end of the market.

If all this sounds similar to Intel's strategy since its switch from the high-clocking Netburst Pentium 4 architecture to the IPC-tastic Core processors, even the code-name for the first Zen processors, Summit Ridge, sounds distinctly Intel-ish. Arguably, however, Zen will succeed or fail more on execution than broad strategy.

Bulldozer's modular architecture could have been a winner. But it was very poorly executed from day one and for a company with limited resources like AMD, rectifying that initial mis-step has proven pretty much impossible. The final question is whether Zen is AMD's final roll of the dice. If Zen fails, does all of AMD go down with it? The answer is possibly. It will depend on AMD's plans to also launch its own chips based on the ARM instruction set, a new architecture known as K12.

A Zen failure will almost certainly kill off AMD as a vendor of x86 processors. If that happens, AMD will be left trying to make a mark on the viciously competitive market for ARM processors. And for the record, AMD probably can't survive solely on the strengths of its graphics chips. If the CPU business collapses, AMD is unlikely to survive as an independent entity.



Can AMD's Zen CPU architecture take the fight back to Intel?

and on the other by an IR camera. Together, these two features allow objects to be scanned for depth and dimensions. Finally, there's a stereo microphone array.

Put all of these sensors together and you have a system that supports gesture control using hands and fingers, facial expression detection, head tracking and object scanning, the latter enabling model creation for 3D printing. It also includes a Voice Assistant that has both basic offline and more sophisticated online components similar to Apple's Siri and Microsoft's Cortana voice control systems.

If that sounds like the kind of high-concept technology Intel often touts but fails to actually bring to market, well, RealSense is actually shipping today in Dell's Venue 8 tablet along with notebook PCs from Asus and Lenovo. That said, we've yet to see RealSense in action, so we certainly can't judge whether it'll catch on. What we can say for sure is that Intel is up against some seriously stiff competition from Apple, Google and Microsoft in this area.

SKYLAKE LOOMING

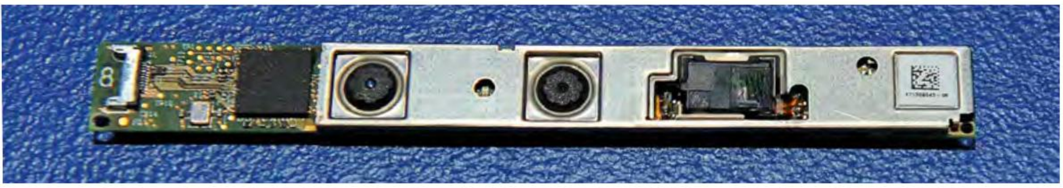
So, that's Broadwell itself covered off. The obvious question is what's next? Actually, that's a more critical question than usual since Intel's 14nm derailment means by the time desktop Broadwells arrive along with quad-core mobile models, the follow-up family of chips, known as Skylake, will be imminent too.

Full details of Skylake haven't been released, but if we combine what Intel has revealed with the best of the leaks and rumours, we can get a pretty good idea of what to expect. Firstly, Skylake is an Intel 'Tock' and that means a new architecture on the prevailing production process, which is now transitioning to 14nm.

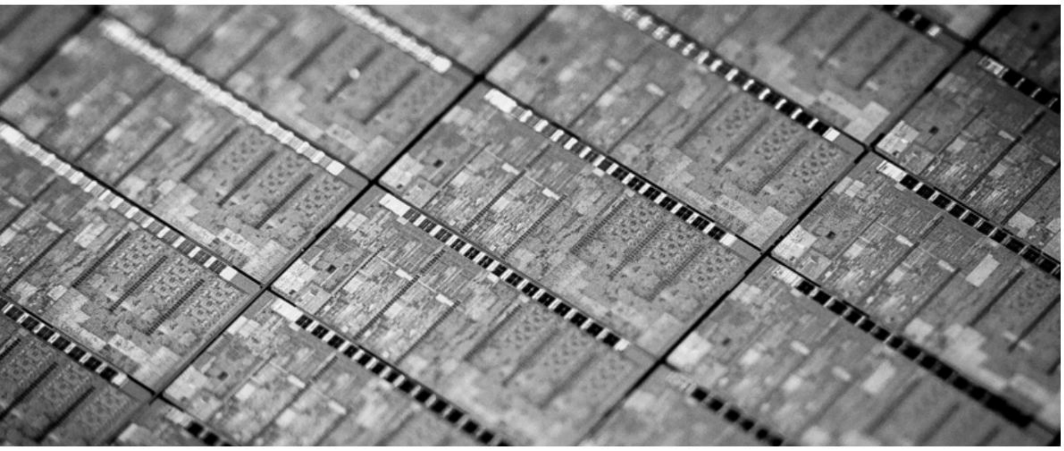
As ever, graphics is a major part of the Skylake package, both literally and in terms of importance. Rumour has it that Skylake will introduce a new 'GT4' spec graphics configuration with no fewer than 72 execution units. That means nine of those eight-strong execution-unit slices instead or six, or a straight 50 per cent boost in computational complexity.

Normally, we wouldn't be hugely excited at the prospect of some far-off integrated graphics core. But Skylake is just around the corner and if it really does have 72 units, it's going to be massively quicker than today's best Haswell graphics.

That said, arguably more interesting are the platform developments that come with Skylake. First up, there's a new



RealSense already ships in Dell's Venue 8 tablet plus some notebook PCs.



To die for? Questions remain as to how Broadwell will exist alongside Skylake.

socket, LGA1151, which breaks backwards compatibility. Where desktop Broadwells will drop into existing Intel 9 Series motherboards, Skylake chips will require a new motherboard.

If that's the bad news, the good news is that the new socket means a properly new desktop platform along with new 100 Series chipsets topped out with the upcoming Z170. Reportedly, both Skylake and the new chipsets will support both existing DDR3 memory and the new fangled DDR4 stuff that's so far been restricted to Intel's high-end LGA2011v3 socket and CPUs. However, actual motherboard implementation will see only one memory type appearing. We won't see boards that can take both memory types.

> It will be very odd to have an older architecture in Broadwell sitting above the newer Skylake in Intel's hierarchy.

DDR4 probably isn't a big deal for mainstream desktop gaming rigs. But the boosted bandwidth should help keep those mooted 72 execution units in the new graphics engine fed with frame data. The other headline grabber is a bump for PCI Express lane availability, up to 20 lanes from 16. That matters because storage subsystems – specifically SSDs – are moving to the PCI Express-based M.2 interface. For dual-card multi-GPU SLI or Crossfire graphics, you want at least eight lanes per graphics card. With an M.2 drive pinching a few of your 16 lanes, there's a problem. With 20 lanes, you've got four spare for a couple of fast SSDs. Perfect.

However, where things get really complicated is the relationship between Broadwell and Skylake on the desktop. Broadwell's lateness combined with Intel's plan to stick with its schedule for Skylake has created some distinct weirdness.

According to leaked Intel roadmaps, this is what it's going to look like. Broadwell desktop CPUs will be the unlocked K-series models only. There won't be any mainstream locked Broadwells on the desktop. Instead, those slots, which represent the bulk of Intel's desktop offerings, will come from the new Skylake family.

It's a really unusual situation and leaves a lot of questions unanswered. For instance, will there be unlocked Core i5 Broadwells with no Hyperthreading, as there have been for several generations? And what will Intel call all these chips? Will it launch what it calls fifth and sixth-generation Core processors? Or will it simply brand them all as fifth generation?

Then there's the not-so-minor matter of multiple platforms and multiple sockets that lack cross compatibility. It's bad enough that Intel now splits its desktop offerings into separate mainstream and high-end offerings. It now seems that, for a while at least, you'll have to choose between two mainstream platforms: the existing LGA1150, which Broadwell CPUs require, and Skylake's new LGA1151 socket.

DOUBLE TROUBLE

What's more, the way Intel has done this is probably the opposite of the ideal. If you've forked out for an expensive unlocked chip, you're likely going to want the latest platform technology with those extra PCI Express lanes and DDR4 support. But those will only be available with locked Skylake chips.

Whatever, it will be very odd to have what is an older architecture in Broadwell sitting above the newer Skylake models in Intel's hierarchy. At the very least, it possibly means that Skylake's CPU cores won't be anything to get excited about. After all, unlocked Broadwells selling as range toppers will need to be faster than their cheaper and locked Skylake siblings or the whole thing really will come tumbling down. All will become clearer in the coming months, but it's odds-on that Intel will have to pull some marketing tricks to make sense of this weird mishmash of new products.

As for what happens after Skylake, we really are into crystal ball territory. There are a few known facts. Skylake will be followed by a family of 10nm die shrink chips called Cannonlake. Due in 2016, they'll come with another new platform, the 200 Series chipset, and pair with DDR4 only.

All of which means we've mixed feelings about Broadwell. We're disappointed that it likely won't push on Intel's game for pure CPU core technology. But the power efficiency and graphics look like a big step forward and it's nice that it should drop straight into existing 9 Series motherboards, albeit with a BIOS update required. How it will all work with Skylake arriving at nearly the same time, however, is far from clear and could determine whether Broadwell makes a mark or turns out to be too little too late. ■

Can Skylake's GT4 graphics give us gaming in such small form factors?

WIN!
AN APPLE WATCH

KEEP UP WITH THE TIMES IN TERMS OF TECHNOLOGY AND STYLE WITH THIS CHANCE TO OWN 2015'S MUST-HAVE GADGET…

5 APPLE WATCHES MUST BE WON!

Smart watches are one of the most exciting new technology categories around and there's surely no more eagerly awaited product than the Apple Watch.

Thanks to a combination of Apple's innate ability to make the latest technology accessible and the unrivalled personalisation that wearable technology provides, the Apple Watch is at the top of many people's wish lists.

With an Apple Watch, notifications appear on your wrist, included apps track your physical activity and exercise sessions, the built-in heart rate sensor enables you to monitor your workout performance, and fashionistas can customise the face of the watch to their heart's content. Naturally, the Apple Watch also integrates beautifully with an iPhone and other Apple devices…

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WHAT IS THE NAME OF THE APPLE WATCH'S BRITISH DESIGNER?

A STEVE JOBS
B TIM COOK
C JONATHAN IVE

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ENTER ONLINE NOW FOR FREE AT: http://bit.ly/watchcompo

The closing date for entries is 1 May 2015. Only residents of the UK and Republic of Ireland can enter this competition. After the closing date, five winners will be drawn at random from the correct entries. Only one entry per household permitted; multiple entries will be disqualified. See **www.futureplc.com/competition-rules** for full terms and conditions.

GAMING

BECAUSE GAMING IS A WAY OF LIFE

What Are You Playing At?

Giving crowdfunding a kicking

"Something about those money-grabbing platforms creeps me out."

I'VE HAD SOMETHING of a difficult relationship with crowdfunding over the years. I don't dislike it for the nature of its concept, but rather for the grip it's held over the gaming community and how some organisations use it as a way of making a quick buck without the red tape of more traditional funding.

Kickstarter has always felt too easy to abuse and I'm left cold by the idea of paying someone to do their job via current 'crowdfunder of the month' Patreon. I've no doubt this Fagin-aping frugalness is part and parcel of me having two kids and a crippling addiction to pro-wrestling and comic books, but there's still something about those two money-grabbing platforms that creeps me out a little. The weird thing is, despite still needing to hand over my cash, the Humble Bundle doesn't evoke the same feeling of powerful dread in me.

IS IT ABOUT TO END? A LIFE BEYOND STEAM PG. 64

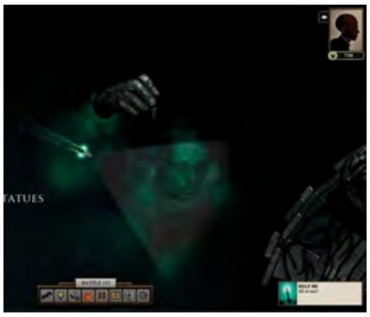
Launched in 2010 (a year after Kickstarter made its own debut), the Humble Bundle is going from strength to strength. Think of it as an ever-changing bunch of DRM-free games and soundtracks that you can pay whatever you want to access. You can even define how much of your donation goes to the developer, how much goes to Humble and how much is given to charity. It's a simple setup and is a great way to directly support the developers you love (the initiative has also raised over $50 million for charity over the last five years, so you can't really argue with that). Last month, the Humble Star Wars Bundle made over $1.3 million in less than a day of its launch. Like I said before, it's a pretty big deal.

I also hate the Humble Bundle, especially one of its most recent, collectible card-related offerings. Up until I hit that button to pay, card games were a genre I'd barely paid any attention. Then I bought this bloody bundle and now I can't stop playing *Scrolls*, *Magic 2015* and *Star Realms*. My vocabulary has become littered with terms such as "gravestorm", "hexproof" and "sacrifice". I've started approaching every decision in life by thinking three moves ahead and checking my hand for a decent spell card to cast. The cards aren't even real! Oh God, this is *FIFA*'s Ultimate Team all over again. Please, someone, think of the children...

–DOM RESEIGH-LINCOLN

HIGHLIGHTS...

72
Dying Light



74
Sunless Sea

76
Evolve

RECOMMENDED...

CIVILIZATION: BEYOND EARTH 2K
PCF299 p62 Its foundation is familiar, but this is a game that's full of surprises and is difficult to master.

ALIEN: ISOLATION
Creative Assembly
PCF298 p64 The game the *Alien* series has always deserved. A deep, fun stealth game set in an evocatively realised sci-fi world.

WILDSTAR
NCSoft
PCF294 p64 Clever questing and a stand-out combat system make for an entertaining MMO that is as large as it is full of character.

SMITE
Hi-Rez Studios
PCF293 p66 An addictive game makes the lane-pushing genre more approachable with smart tweaks to the old formula.

Life Beyo

Are there any realistic alternatives to Steam, for gamers or developers?

BY DANIEL GRILIOPOULOS

Our beloved editor Alan loves his thought experiments. “So, if Steam evaporated tomorrow,” he mused, leaning back in his throne made of last-gen graphics cards, “where would gamers go for their games? Get on it.”

Of course, there’s no evidence that Steam is going anywhere, or even changing. But that’s not an answer that will make Alan very happy. To be fair to him, however, we’ve no idea of Valve’s long-term plans – the company is about as open as a paranoid clam. It’s a show of how little we know that before Microsoft revealed its big Windows 10 surprise to be HoloLens, it was mooted that it could’ve been a Steam buy-out. (Not such a stretch, given Valve’s owner Gabe Newell spent 13 years working for Microsoft.)

But it could end. And what then? Where would we get our PC games? Well... plenty of places (see “Letting Off Steam” on page 66). Steam isn’t just about buying games, though, like it was back when it launched way back in 2003.

nd Steam

ILLUSTRATION: SIMON WINDSOR

It fulfils most of the roles that gamers need. It handles digital distribution, digital rights management (whether you have the right to play that game or not), multiplayer and matchmaking, family-sharing, social networking, updates, cloud saves, groups, and now curation. For free!

It's hard now to remember quite how terrible it was to play PC games before Steam – when games such as *Vampire: The Masquerade – Bloodlines* could launch the same day as *Half-Life 2* but be broken beyond repair and there be no easy way to get a patch. Yes, you could go to FilePlanet and download one, if you were happy to wait for a couple of days, had paid for a subscription, and if the developer had made one (which *Vampire* developer Troika never did).

And Steam isn't just a place for gamers to buy games. It's also a place for gamemakers to sell games. It supplies a marketplace; the ability to track sales and player statistics; a way to set up discounts; free APIs to do your own code with; in-game achievements; network code and matchmaking; in-game micro-transactions; and support for modded content. All that for around 30 per cent of your revenue. Compared to the usual 70 per cent that retailers once took, that's an amazing deal.

Despite this wealth of functionality, however, all's not well in the land of Steam. It's possible the platform's Golden Age has already happened. Valve, from the outside, seems increasingly unproductive relative to its headcount and influence. It's effectively a monopoly owned by a single person. Anything could happen if he moves on.

And perhaps it's not healthy for games, as Leaf Corcoran, who set up the free indie game distribution site itch.io thinks.

The problem is that nothing else replicates the functionality of Steam. Three other platforms come close – Origin, U-Play and Battle.net – but they're closed platforms, only selling games from AAA publishers. So is there any software that replicates each of Steam's functions? Read on to find out.

First up, how do non-Steam games ever get updated? Well, the publisher-specific services – Origin, uPlay and Battle.net – tend to update their apps themselves; GOG.com will notify you that downloads are available if you log onto its site or leave its downloader running; and some popular games have bespoke updaters built in – think *Minecraft* or *Terraria*. Most, however, just rely on you checking in on their website every now and then.

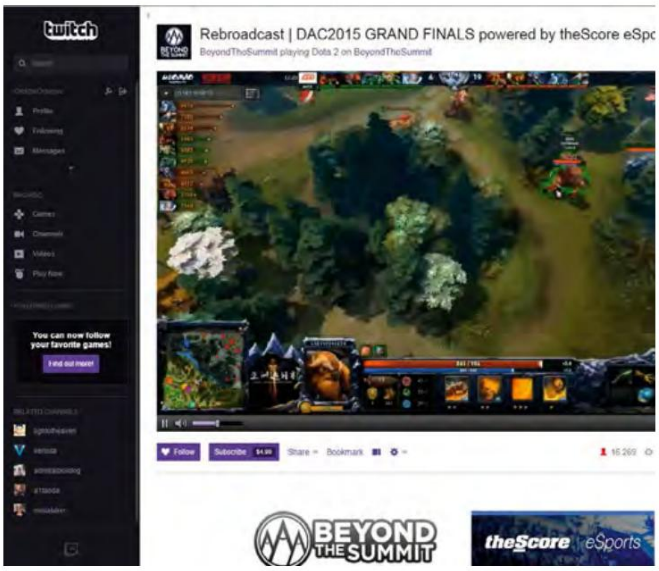
So is there multiplayer available outside of Steam? Unless it's built into the game, no. Older multiplayer hosting services like GameSpy have died off, meaning Steam is pretty much your only way of finding multiplayer games, especially as many devs use Steamworks for their multiplayer tech.

GOING TO THE SOURCE

How about discoverability? Well, gamers can easily find new games through multiple sources, outside of Steam's rating and curation systems. Specialist media, such as the very magazine you're currently pawing with your grubby mitts, or independent sites like RockPaperShotgun, can recommend games. And it's easy to buy these games. Very few titles are Steam exclusives these days, with most games also being available through secondary digital distributors like GamersGate or GOG.

Indeed, itch.io makes Steam's line-up look boring and conservative, showcasing all the most weird and wonderful games from every corner of the world – and most of them free. Its creator, Leaf Corcoran, remembers there was no easy way to publish an indie game before it, with indies begging for votes on Greenlight. "It was depressing to see, and absolutely unnecessary for the sellers," says Corcoran. "Selling your game should never be about winning a popularity contest or having someone else tell you it's okay to sell. I think one of the reasons itch.io has been successful in making a lot of traction among all the other game marketplaces is that it hosts content that's actually different. The low barrier to entry for publishing encourages a lot of unique content to be uploaded. Itch.io is not just another site selling Steam keys."

That said, nowhere has the combination of AAA publisher, iOS conversions, F2P MMOs and indie titles that Steam does – it's the only marketplace that shows such a large selection of the market. And services like GameSessions.com allow players to try Steam games before they buy. Steam also has another feature that might seem strange, but is actually crucial – social networking.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ABOVE Game streaming is one area Steam comes second, due to Twitch.

GameSpy Arcade

The decline of GameSpy means Steam rules multiplayer.

GETTING PERSONAL

Social networking is the magic juice that makes achievements worthwhile, and is what the platform bases its game recommendations on. Players can rate games with the aggregate score appearing on the game's store page, replacing the critic review-derived MetaCritic score, and any individual or group can set themselves up as a Steam Curator. Why read a magazine

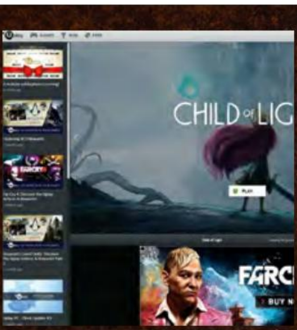
LETTING OFF STEAM

The current alternatives to Steam

Origin
The Fastest Battlefield Yet
BATTLEFIELD HARDLINE
INQUISITION

Origin

EA pulled its games from Steam, so Origin is the main place to pick them up (though U-Play also hosts them). It has social network features no-one uses, introduces annoying pop-ups and occasionally gives away free old games and gametime for new EA games.



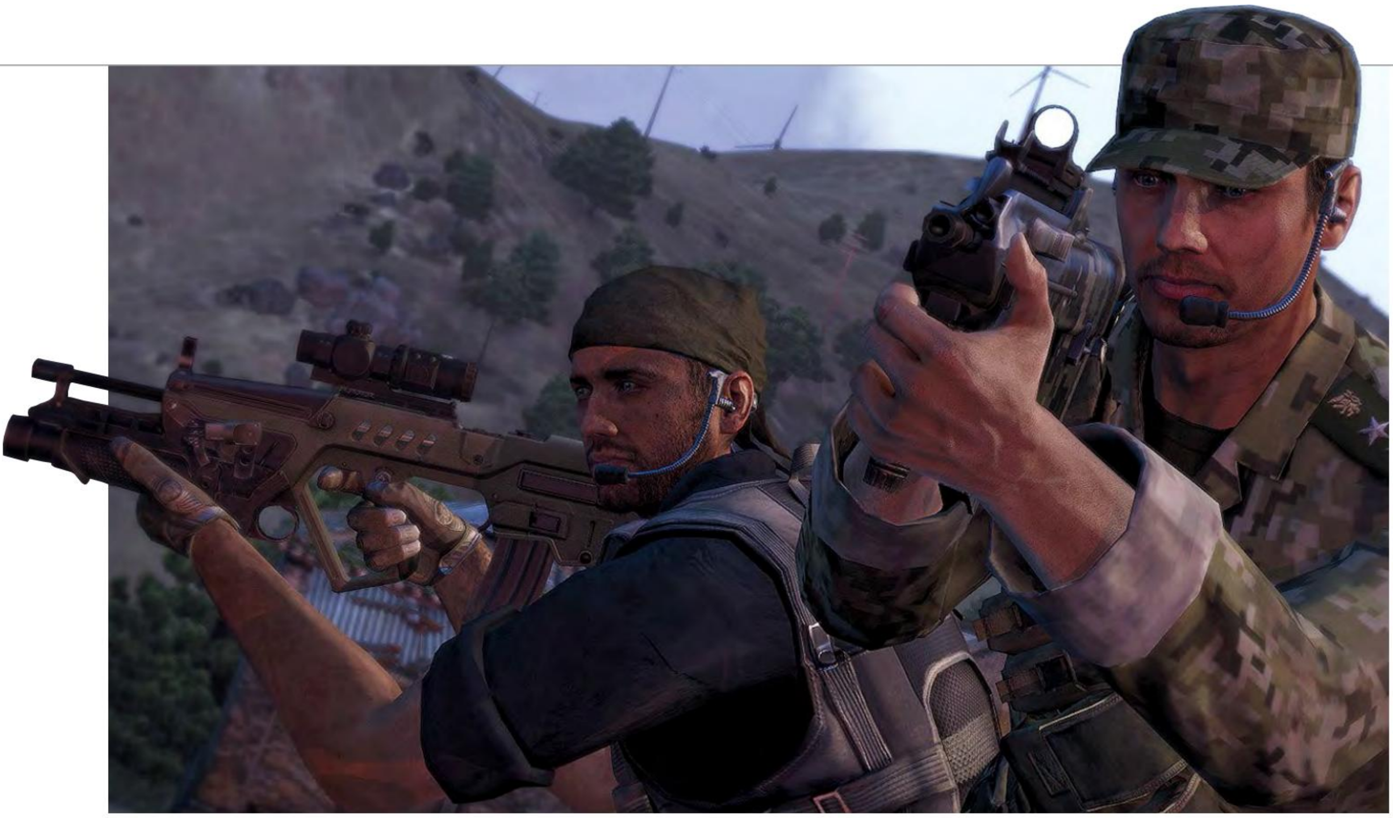
U-Play

Owned by Ubisoft, this app sells games from several AAA publishers, including Capcom, EA and Square Enix. Lets you unlock trophies which provide points for buying DLC. Has social network features that no-one uses and annoying pop-ups in otherwise fun games.

STARCRAFT
STARCRAFT II
Legacy of the Void Announced!

Battle.net

The only place to buy and play the five-or-so Blizzard games, and it's owned by Activision-Blizzard. It has social network features that get heavily-used, given all the games have strong multiplayer. It gives nothing away – nickel and dimes you heavily for in-game content.



ABOVE: 'Degrading' games is Bohemia Interactive's non-Steam piracy solution.

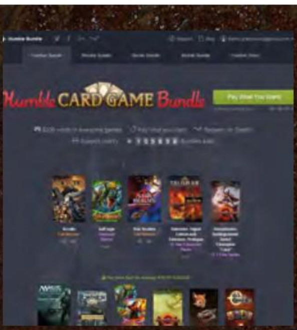
review when your trusted friends all say you should get a game?

Similarly, though the Steam broadcasting tech is welcome, it's underutilised compared to that on the Playstation 4. Indeed, Twitch.tv is the big game streaming service, which produces and absorbs much more of the game streaming than Steam. Most users of that use products like the free Open Broadcast Software to create their videos, and Twitch itself to find an audience. Like *World of Warcraft*'s in-game voice tools, Steam had to offer video streaming but it's unlikely to ever displace Twitch.

The only app we're aware of that replicates any aspects of this social networking is the Raptr app, which also ships with ATI graphics cards. This social networking app runs in your dashboard and tracks all your gameplay, across many platforms, including PC, so you can see what your friends have been up to. It also replicates the community and groups that makes playing games on Steam so handy, especially for finding the hardcore groups to play complex games like *Mount* and *Blade*, or guides to complex RPGs like *Divinity: Original Sin*.

However, even Raptr can't handle another part of Steam's unique offering – family sharing. This is a little-known system that allows players to share games with other players. As long as you've logged-in on a computer and approved it for your account sharing, other players on that machine can play your games when you're not playing them. It's an extremely helpful part of the Steam experience that can only be replicated through non-DRMed games and, essentially, piracy. We use it for sharing games with our families, but are aware that most players don't even know it exists.

> “Nowhere has Steam's combination of AAA publisher, iOS conversions, F2P MMOs and indie titles.



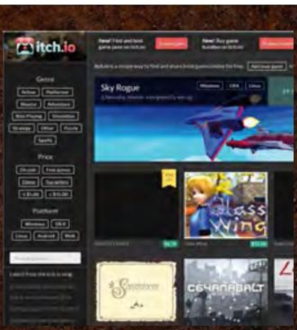
Humble

Mostly sells bundles which get games huge distribution but almost no money for the developers. Humble also sells mobile phone games. They also distribute games, with 10 per cent of every sale going to charity and just 15 per cent to Humble (half Steam's rate).

SUNLESS SEA

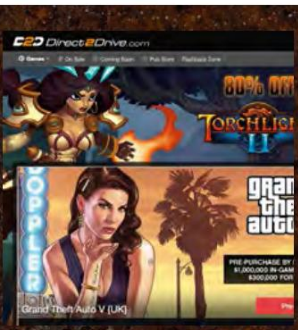
GOG.com

Originally 'Good Old Games', it focused on selling no longer available classics, in forms that work on modern computers. However, as it's owned by CD Projekt (developers of *The Witcher*), it's taken to selling more new releases. It's the likeliest alternative to Steam.



Itch.io

Sells games solely from independent game developers (though its founder Corcoran told us he's open to hosting AAA games). Also organises game jams, sells game bundles and gives away free games. No money goes to itch.io. This is the place to buy your game!



The others

Gamersgate (not related to the insane mens' rights activism), Green Man Gaming, Direct2Drive and many smaller sites make up a small part of the market. Some of them have original twists – such as GMG allowing users to resell digital games they've bought.

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Two other unique elements of Steam are replicated by another major gaming site – Kickstarter. Yes, Steam's Greenlight system lets gamers vote on the titles they'd like to see, and the Early Access system allows those voters to try (and to fund) games before they're ready – as long as they're in a vaguely playable state. But Kickstarter goes further. It allows players to approve games and gain access to the alphas when they're in a much worse state than Steam. However, Kickstarter offers no guarantee that the game you're paying for will ever be playable, whereas Steam Early Access at least means you'll have access to a broken version of the game.

ARRESTED DEVELOPMENT

So, while there's software that replicates most of the Steam experience for the gamer, it's not easy to get hold of and doesn't talk to the other software in the way that Steam does. The situation, however, is far worse for developers.

Digital distribution itself is the smallest part of the problem. It's exceptionally easy to distribute your game these days, given the wealth of data and store management software around. If you want to sell it directly, there's a ton of e-commerce software available, starting with something as simple as Paypal, if you're happy handling the software distribution and hosting yourself. If you want to automate it, software like X-Cart or Shopify can handle that for you, for a reasonably small fee.

Of course, getting someone to find your software is harder. How are people going to find out about your new game? "For indies the number one concern is visibility," says Tomasz Nalewaj, brand director of Good Old Games (GOG). "Even the best game ever isn't going to sell a single copy if nobody knows it's out there, and that's a very real concern in today's market. Greenlight and itch.io are part of the solution, but they're not perfect. If everyone is visible, then no one is. We go from a vacuum to white noise, and we're back to square one."

THE FREE MARKET

Most games are discovered through Steam, through adverts, or through the media and YouTubers. But it's a huge time-sink to reach out to the last two, and it's expensive to employ a PR or community manager to do it for you. And advertising is expensive.

If tech such as HoloLens catches on, there'll be a whole new genre of games.

THE HAND OF GOG

Tomasz Nalewajk, brand director of Steam's nearest rival, Good Old Games, reveals his vision for PC gaming

How do you see the marketplace for PC games at the moment?

Stronger than ever. Gaming in general is exploding in the mainstream, it's no longer this kind of niche culture. People are actually proud to be gamers now!

Do you want GOG to grow into another Steam?

We want to grow and expand our userbase, but not at any cost. We want people to be confident that they can browse GOG.com, find something that looks cool, and end up with a solid game. Sure, we could give our catalogue a major boost if we just said yes to everything, but we much prefer our way of doing things, we think it makes for a better experience. That means that we only release games that we, as gamers, actually want to play. We consider it a "boutique approach". The recipe for that is pretty simple: we actually play them. We'll try the game out, see if we like it, and go from there. GOG.com is growing all the time. We started out releasing good old games, and have since ventured into great indie titles and day-one premieres. We have no intention to stop improving either, so our next big step will be GOG Galaxy. We call it "the truly gamer-friendly DRM-free online gaming platform" and we want to make sure it's not just mere rhetoric. So yes, we plan to offer our community the standard stuff like achievements, stats, chat, etc., but the keyword here is "offer". You can use the online features if you want, but you can always rely on the old fashioned way – just you and your games.

Will Windows 10, with its focus on games, change the market?

Windows is, most definitely, a really huge part of gaming. In that sense, we're happy to hear Microsoft is placing some more importance on supporting our favourite hobby. It used to be that you absolutely needed Windows to really game, and while that's changing for Mac and Linux users (especially when it comes to the indie scene), those operating systems are still a far cry from offering as large a backlog and equal developer priority. But who knows, maybe Microsoft is reacting to those very changes, trying to stay competitive. That's definitely a good thing for the market. This sort of thing is always tough to predict though, and I'd rather not make any bold, sweeping statements.

Do you think new technology, such as Oculus Rift or HoloLens, will affect the market for games at all?

Absolutely. All it takes is a single look at people's reactions when they first try these new technologies to see we're definitely on to something. If the tech catches on, I think we'll even be in for a completely new genre of games designed specifically for VR headsets. At the same time, not every type of game out there is going to benefit: classic point and click adventures, 2D platformers, and most "retro" experiences come to mind. The tech is not for everyone either, virtual reality headsets really take up all of your senses at once, and for some people that's just too much – they're not interested in that kind of immersion. In the end, only time will tell. Once upon a time 3D TVs were going to be the next big thing, and that didn't turn out to be quite as popular as predicted.

So expensive that the cost to find a single buyer is often more than the money they'll spend. Steam is still the best way to let people find out about your game, if you can get on it.

That said, it seems to us that even Steam's capability to market games is waning, mainly due to the weakening of its internal curation in favour of user curation. This new user curation system allows gamers to recommend games and gain followings on the basis of their recommendations. At the moment, it's mainly allowing big name websites and YouTubers to extend their brand, but it really amplifies the success of better-known games, such as *Shadows of Mordor*. A great game coming out of nowhere still needs extensive marketing or viral word of mouth to succeed, like *Spelunky* had.

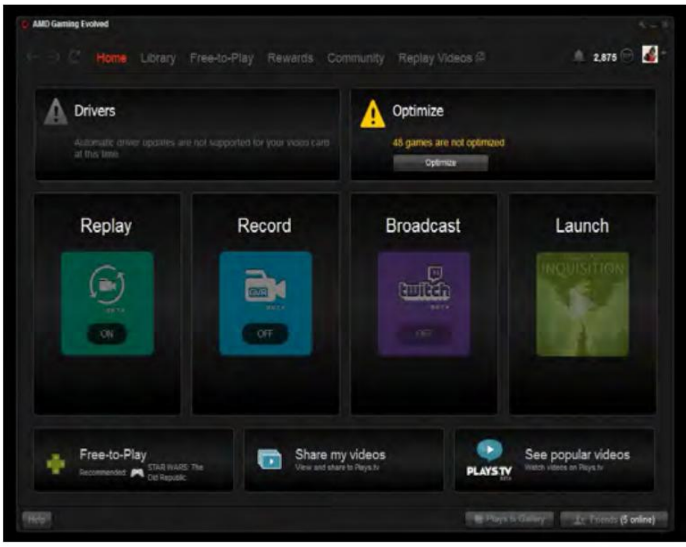
ACCESS DENIED

Of course, once a buyer has your software, you don't want them to just give it to anyone else – unless you're GOG, which, as a point of pride, or as a marketing stunt, doesn't have any copy protection. Digital Rights Management (DRM) software is the usual method of restraining usage to a single purchaser, and it's included as standard in Steam, Origin, U-Play and Battle.net.

There are off-the-shelf solutions for this – simple CD key software locks are available for developers, and the infamous SecureRom and SafeDisc DRMs are well-known, but the problem is you risk preventing legitimate users who are temporarily without the internet from playing their games. Steam handles this with an offline mode, which, while unreliable, allows you to play most games offline. Or you could do what Bohemia Interactive, creators of *ARMA* and *Operation Flashpoint* do, and allow players to play the DRM-free games, but gradually degrade their experience. If you're playing a cracked or DRM-free version of *ARMA*, your guns gradually lose their accuracy and on occasion you turn into a bird. That's sadly not something that's available off the shelf...

The downside of DRM is for the gamer – games released through Steam won't work if Steam goes down. Online libraries have closed before, like the original Sony Music Entertainment store. So, if Steam did collapse, we could lose access to our games. And we likely wouldn't have a legal foot to stand on, as many manufacturers are moving towards selling software as a license, rather than a product, turning it from something we own into something we borrow. GOG's DRM-free system certainly seems better than that.

> “A great game coming out of nowhere still needs extensive marketing or viral word of mouth to succeed.



Automatic driver updates are not supported for your video card at this time

48 games are not optimized

ABOVE: **Raptr matches Steam's social networking, but lacks a family sharing system.**

And how do you do multiplayer or matchmaking without Steam? There used to be an array of off-the-shelf solutions, like GameSpy, but with Steamworks supplying so much of the tech, they've mostly disappeared. Developers can create their own, but that's a hell of a lot of extra work. And, as the *Magicka* developers found out, if it doesn't work, you can end up with a lot of upset players. As Paradox North's Peter Cornelius admitted to us, getting the multiplayer working in *Magicka 2* was “a big feature”.

Byron Atkinson-Jones, director of Xiotex Studios, recommends the Player.IO dev kit, though with caution, as Yahoo has just snapped it up. It's a set of free systems that provides the code for networking,

VAT-MESS

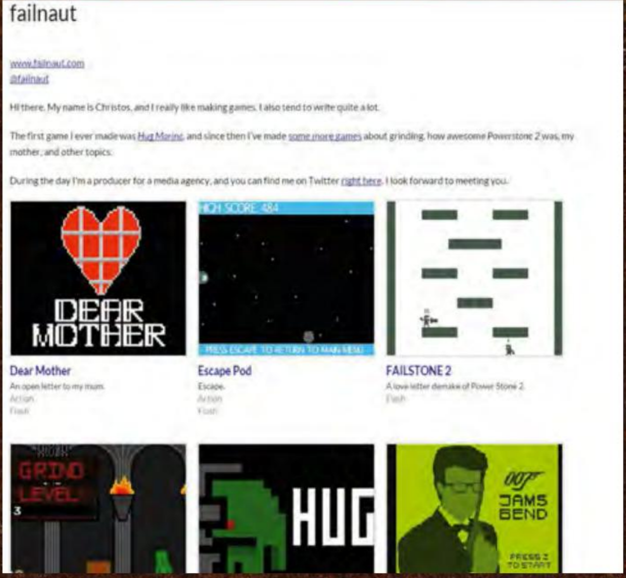
Taxing times for indie developers

If it wasn't difficult enough for indie developers to get attention for their games, the European Union's decision to mess around with the taxation of digital products really didn't help. Essentially, the EU decided companies across Europe should pay the relevant amount of VAT for every sale in every country, rather than paying sales tax where they are registered or based. Suddenly a market for games the size of the USA wasn't available to indies.

A scheme called MOSS was meant to help, but only applied to VAT-registered firms, which doesn't include many indie devs. Smaller distributors like itch.io simply said they wouldn't do the admin. For indie developers, it promised only a mountain of paperwork.

As one indie dev, Christos ‘Failnaut’ Reid, explains, the scheme was well-motivated but not well thought-through. “Before, businesses such as Amazon have been able to duck this by running sales through Luxembourg, but VATMOSS now ensures everyone pays their way.”

“It was, however, dumped on a community of independent creatives who then had to



www.failnaut.com
@failnaut

Hi there. My name is Christos, and I really like making games. I also tend to write quite a lot.

The first game I ever made was Hug Marine, and since then I've made some more games about grinding, how awesome Powerstone 2 was, my mother, and other topics.

During the day I'm a producer for a media agency, and you can find me on Twitter right here. I look forward to meeting you.

Dear Mother
An open letter to my mum.
Action
Flash

Escape Pod
Escape.
Action
Flash

FAILSTONE 2
A love letter demake of Power Stone 2
Flash

An increasingly complex European tax system means many indie developers choose to rely on donations rather than sell games.

ABOVE: *Terraria* is one of the few games to have an in-built non-Steam updater.

cloud saves, microtransactions and a few other essential items.

Similarly, GOG is developing its own alternative to Steamworks, called GOG Galaxy. "Support for network games is actually one of the reasons we're developing GOG Galaxy," says GOG's Nalewajk. "There are a few games out there that use the tech already. That includes the recently released *Double Dragon Trilogy*, *The Witcher Adventure Game* and *Alien vs Predator Classic 2000*, and there is going to be a whole lot more coming up in the future."

ANALYSE THIS

A newer essential swims into focus once players have actually got their hands on your game – metrics. You want to know who's buying your game, where from, how long they're playing for and, crucially, why they're stopping playing. Atkinson-Jones recommends Google Analytics for this as it's "really good and free", though it's more useful for tracking website hits than in-game difficulty spikes.

Two more essentials are about letting the developer update the game remotely and other players mod it. Steam provides easy, free updating, while Steam Workshop provides easy-access modding support, but you still need to build it into your game and people still need to make stuff. As Atkinson-Jones says, "Modding support has two sides. The first is that your game has to support it and that's pretty much up to you. The second is where mods are stored and how you get hold of them. For very large scale games you are going to want a Content Delivery Network, like Amazon."

A FOGGY FUTURE

It's clear there's no one-stop alternative to Steam for gamers. The wealth of titles the system offers, the competition on price and the social network element have prevented anyone making a single competing system. The few that are functionally similar are made by game publishers and rarely publish other games.

For developers, however, there are a lot of technical alternatives, and if there's one thing indie developers know about it's sharing information to make games cheaply. So the biggest problem for indie developers is getting sales. That means letting people know about your game and – despite the recent flood of poor-quality games – Steam remains the single location that PC gamers go for their games.

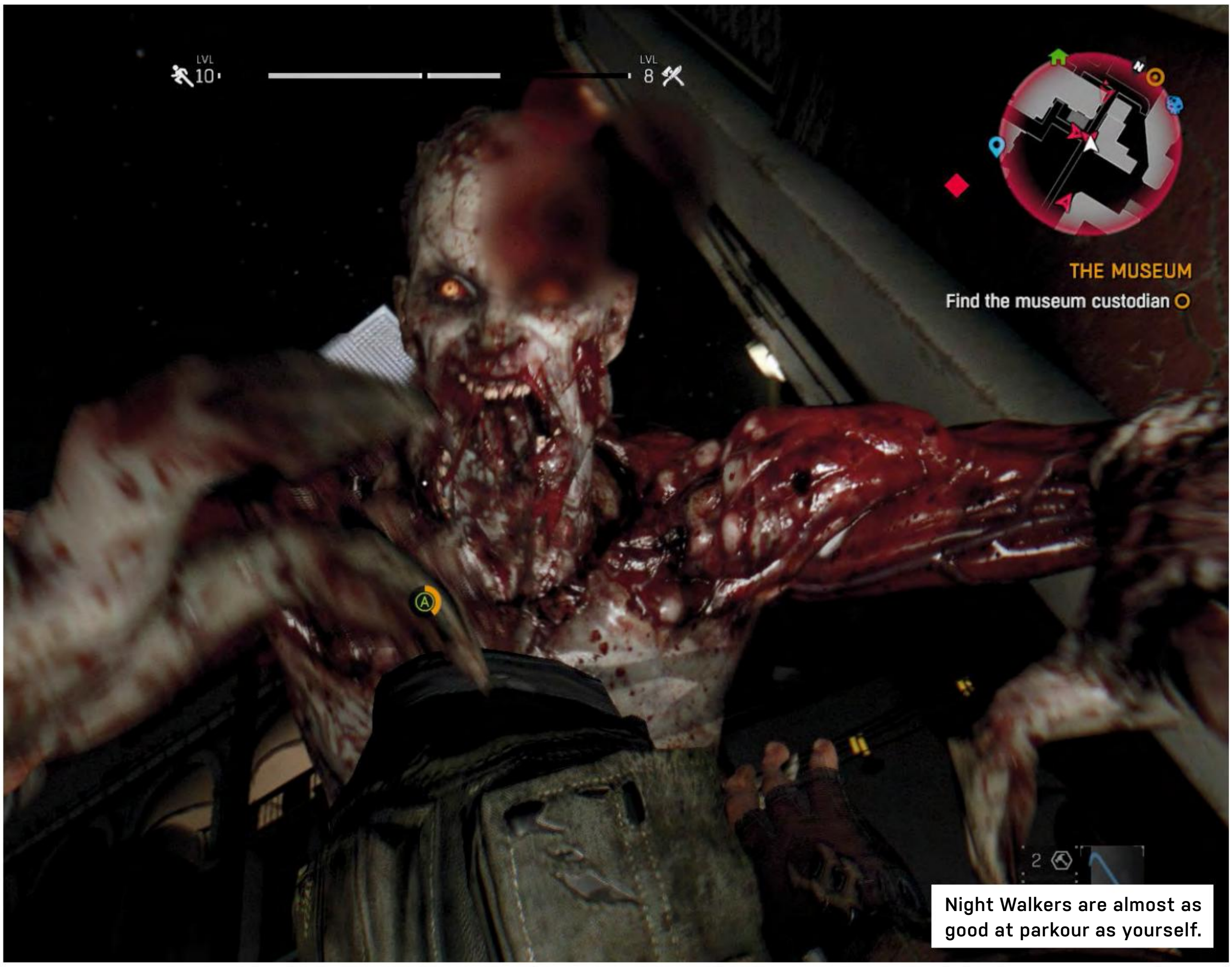
What does that mean? It means that PC gamers look first at Steam for their games. If you're a developer and want your PC games to sell, you hit Steam first. If you want to sell elsewhere, you have a lot of extra work to do – and that effort's probably better spent on porting the game to mobile or consoles, not selling through a third party or directly. So it looks like Steam will carry on dominating the market, until it chooses not to. ■

BELOW *Vampire: The Masquerade* was a pre-Steam disaster.

scramble for a solution, which has been unfortunate. Having to personally process that amount of location and VAT data is a significant time-sink, and as someone both making games and working a full-time job, it added another spinning plate to an already worrying collection." Christos switched to a donation system to avoid the system entirely.

Thankfully, itch.io can now handle the VAT calculations, meaning the developers can receive payments again. As itch.io's creator Leaf Corcoran recalls: "It required a lot of infrastructure changes and a lot of my time. It derailed a lot of other new features that were planned. Additionally, in the limbo period where I was still releasing updates for VAT, a lot of developers had taken down their games. It was quite an unfortunate situation." Despite his efforts, many smaller EU developers can't sell their games directly, as they're still not eligible for MOSS. Many have resorted to giving them away and asking for donations instead.

Though this situation has now mostly been resolved, it still shows that, whether in the EU, US, or anywhere else, the digital downloads market remains grounded in local laws. And if local legislators or anything else makes games more difficult to sell in a given market, then indies will either break the law or stop selling.



Night Walkers are almost as good at parkour as yourself.

Dying Light

Open-world zombies come up short on soul

FOR ALL ITS FLAWS, 2011's *Dead Island* has become the start of a booming media franchise. The open-world zombie-survival title will spawn two spin-offs this year: *Dead Island 2*, which is being handled by Yager Developments, and *Dying Light*, its spiritual successor from original developer Techland. *Dead Island* was not without its problems – notably a lot of grindy zombie action – but with *Dying Light* Techland has introduced frenetic parkour into the mix of blood, guts and gore that makes up the modern zombie game.

Dying Light's threadbare plot features Kyle Crane, an undercover operative tasked with entering the Middle Eastern city of Harran to collect a top secret file. When he arrives he finds the place in disarray – not really a surprise considering most of the residents are zombies. He's quickly recruited to do side quests by a ragtag group of survivors holed up in a tower block, but obviously they don't know the true nature of his objective. To add to his woes, Kyle has been bitten by a zombie and he's slowly turning into one, meaning he's effectively double-crossing the survivors, himself and living people in general.

Crane doesn't have much to assist him in his quests across this rabid metropolis, other than a handful of withered weapons, balls of steel and some swiftly learned parkour skills. He can run and jump his way across the city, hauling himself onto ledges, vaulting over walls, and cat leaping onto overpasses. This energetic method of getting around makes sense in Harran because the floors are basically lava.

HARDCORE PARKOUR

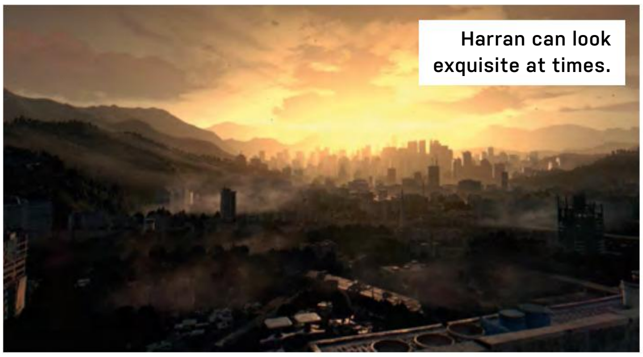
As soon as your feet hit the asphalt you become to zombies what One Direction are to most high school girls. The living dead will shuffle towards you and attack, and while it's generally not enough to kill you, it's just plain annoying. The fragile nature of your weapons doesn't help, so you want to avoid combat unless it's absolutely necessary. Thankfully Harran's numerous rooftops are the safest places to hide and traverse. It takes a little adjustment, but one of the game's greatest joys lies in successfully planning and executing a rooftop manoeuvre.

Unfortunately, unsuccessfully planning and executing a rooftop manoeuvre is pretty damn frustrating, especially if you mistime a jump and plummet to your death, or just clumsily stumble off the top of a building. *Dying Light* doesn't include quicksaves or fast travel, and it even subjects you to an experience point penalty if you kick the bucket, so you've got plenty of compelling reasons to stay alive.

To begin with you'll kill yourself more often than you get eaten by the undead, but once you get the hang of it, it becomes fluid and exciting. The parkour's not quite as adrenaline-pumping as it is in *Mirror's Edge*, but what it lacks in stimulation it makes up in urgency. As impressive as *Mirror's Edge* is, it's a game that flails around trying to find a reason for you to suicidally leap across breakneck gaps. Motivation isn't a problem here – you simply don't really want to become chow for the once-living.

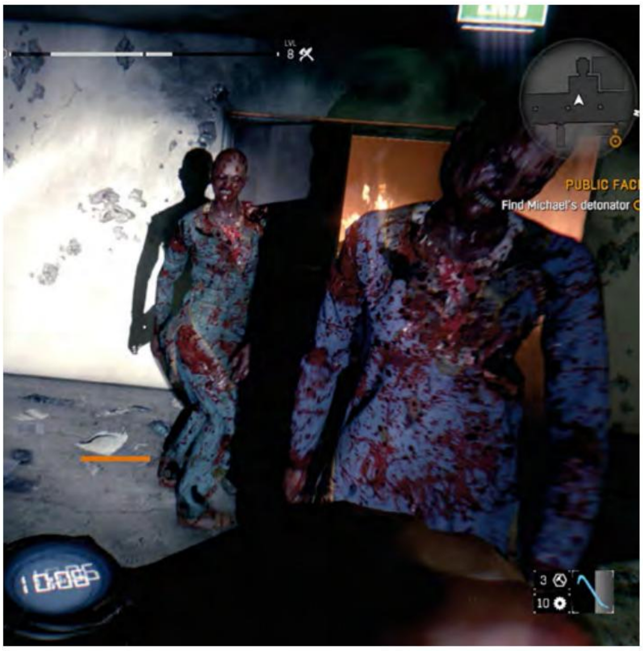
It's unfortunate, then, that the novelty of hauling yourself out of the way of plagues of zombies wears thin so quickly. The plot lurches forwards in a series of convoluted coincidences and cardboard characterisations. It pales in comparison to the *Fallout* series, which uses a similarly

What happens when you drink too much orange Mountain Dew.



Harran can look exquisite at times.

Sometimes, nothing is better than a poke in the eye.



You collect penalty points each time you die, so get to work.

desperate scenario to probe the darker regions of the human psyche in extreme conditions, but manages to keep up a pitch black humour all the way through. The closest you'll get to funny here is kicking a zombie's ass until it falls into a spike and dies – a technique which works surprisingly often, by the way.

Other zombie-death techniques result in some gleefully deranged moments, too. Whacking a zombie with a variety of implements results in big chunks of rotting flesh flying out of their sides, and their love of loud noises results in all sorts of explodey fun. Certain pointy weapons can be thrown at zombies, but it falls apart a bit as soon as you get your hands on an automatic rifle – picking off the undead from a rooftop is simply so easy that it soon becomes mundane. The game even almost apologises for this with two visits to the old take-his-guns-away trope.

On a purely technical level *Dying Light* is still quite an achievement. Techland has not only built a city, but configured it so that you can fluidly parkour across it without clipping through the landscape. We only got stuck once – behind a pile of tables and chairs while we tried to hide in a school, and, to be fair, this is the kind of thing that happens to us in reality. Darkness is handled really well, too – night is a time when it actually gets pitch black, and your flashlight attracts Night Walkers, the scarier zombie variant that you can also play as in the enjoyable asymmetrical multiplayer part of the game.

CRAVING THE INSANE

Dying Light hits something of a crescendo, and becomes especially good-looking, once you escape the slums and enter the opulent old town, where you vertiginously sprint across copper rooftops and slide down zipwires.

It's here that the game really finds itself, tightening the bagginess of the first half of the game. It's enough to make us wonder if Techland's next game should be more linear and less open world – the company is great at building zombie playgrounds and the means to negotiate them, but not so hot when it comes to tying them all together with interesting things to do.

There's certainly potential in *Dying Light*. The mere concept of 'zombie parkour' is surely enough to put a smile on even the most cynical of gamer's faces, and it can be hugely pretty, and fun, at times. But it lacks the vital surprises and shock twists that we've become accustomed to in the best open-world games – a mere drop of *Just Cause*'s or *Saint's Row*'s insanity would have gone down well here, while more recent *GTA*s proved you can tell intimate human stories in the big city. The distinct lack of these elements makes *Dying Light* a game about the undead which fundamentally lacks both life and soul.

–HENRY WINCHESTER

VERDICT
7

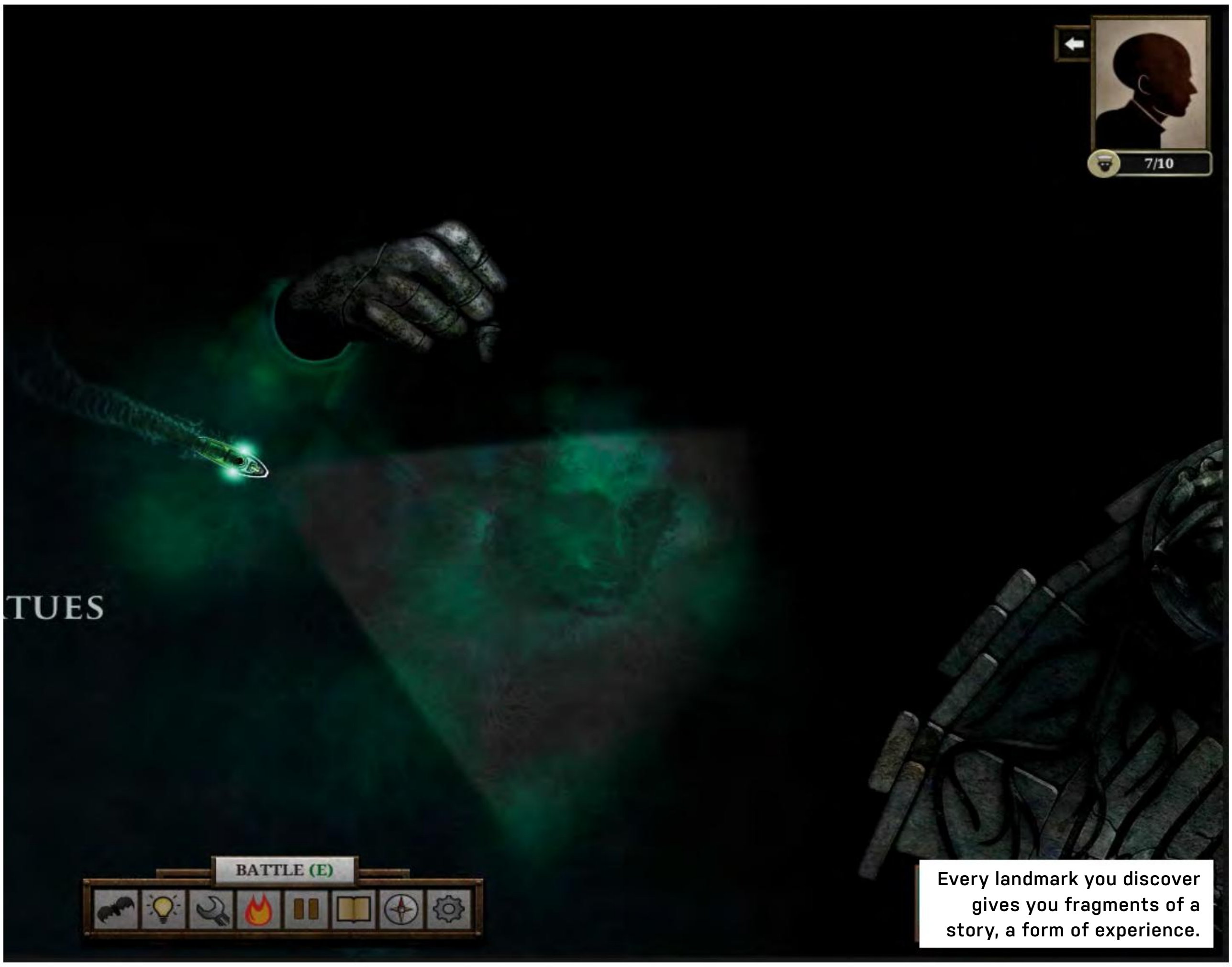
Dying Light

LIFE Fun parkour; good combat; handsomely mounted; decent multiplayer; excellent zombie dismemberment system.

DEATH Thinly plotted and predictable; no real depth; frustratingly unbalanced at times; doesn't live up to its promises.

RECOMMENDED SPECS 3GHz+ CPU; 4GB RAM; GeForce GTX 560/Radeon HD 6870.

£40, www.dyinglightgame.com, PEGI: 18



Every landmark you discover gives you fragments of a story, a form of experience.

Sunless Sea

Sail into Hell's seventh circle, and back again

WE DON'T REMEMBER where our first captain was lost – almost certainly sailing in home waters, between Fallen London and Hunter's Keep. Later captains – men, women, citizens, all of the same doomed family – made it further. Another, fleeing with money stolen from the Smiling Man, made it as far as Khan's Shadow before the Khanate Navy sent his raggedy boat to the sea's bottom. We think one froze to death in the waters off Frostmourn. But none retired to a quiet life to put their seaboots up on the table. They all died in the shadowed seas, leaving their meagre legacies to the next generation.

Sunless Sea is a narrative-heavy sailing game in a version of Victorian London that's literally descended into hell. Players take the role of a sea captain who sails that Unterzee, the great pool of water that fills the cavern to the east of the fallen city. You decide your goal at the start of the game – whether that's to find your father's bones, amass a great fortune or just to have more stories to tell than anyone else.

You fulfil your goal by sailing the seas, talking to its denizens and pursuing the stories of those you encounter to their final conclusion. However, the world is extremely hostile, so death is always just around the corner, either through the top-down exploration system or story choices. Players have to be careful or they'll have to restart from scratch (including the resetting of nearly all the story elements) with a new captain.

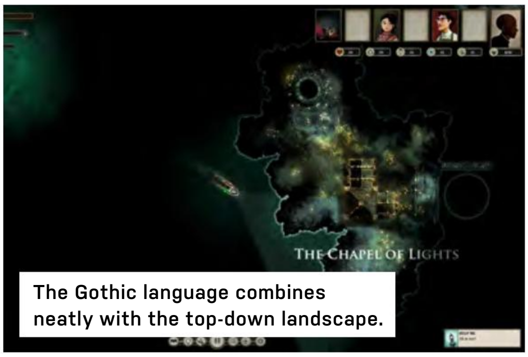
SEA SKILLS

Shortly, this is a combination of a roguelike and a narrative game. Though they're both implemented exceptionally, we'd quibble whether the two core game types fit together well. Roguelikes require relentless replays and easy, frequent death. Narrative games are best when you encounter each story element just once and, as *Monkey Island* demonstrated, are better if they have no fail state.

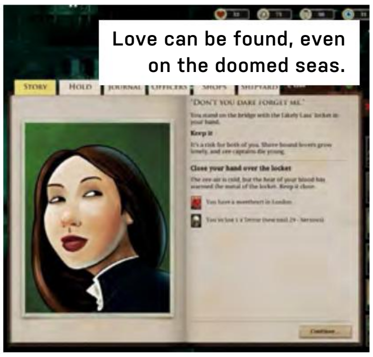
Developer Failbetter tries its damnedest to make these two work together, but they aren't a natural fit – meaning the game's normal mode, with permadeath and no manual save, simply doesn't work as well as the 'save whenever you want' mode. When you've replayed the well-scripted Hunter's Keep sequence for the tenth time, it gets wearing, and you may find yourself switching to the more-forgiving manual mode, just so you can enjoy new content, rather than grinding away at the (slightly dull) exploration roguelike.

Despite that, *Sunless Sea*'s narrative is compelling enough to support the slightly shonky main structure. Fallen London is where you start your journey and where you return each time, to hand in quests and sell your loot and trade goods. But as you explore the world, more prospects open up and previously hostile islands reveal secrets – while previously welcoming islands close down.

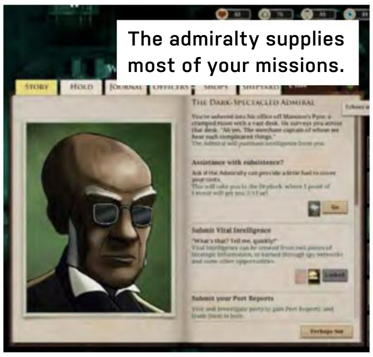
They do this through a choose-your-own-adventure style game, mediated by your character. Each captain has a set of abstract skills derived from his abilities and those of his officers. So a high veils skill will allow you to avoid being spotted by enemies at sea, as well as passing tests on land that cover sneaking and deception. A high pages skill allows you to learn faster, hence unlocking increases in other skills



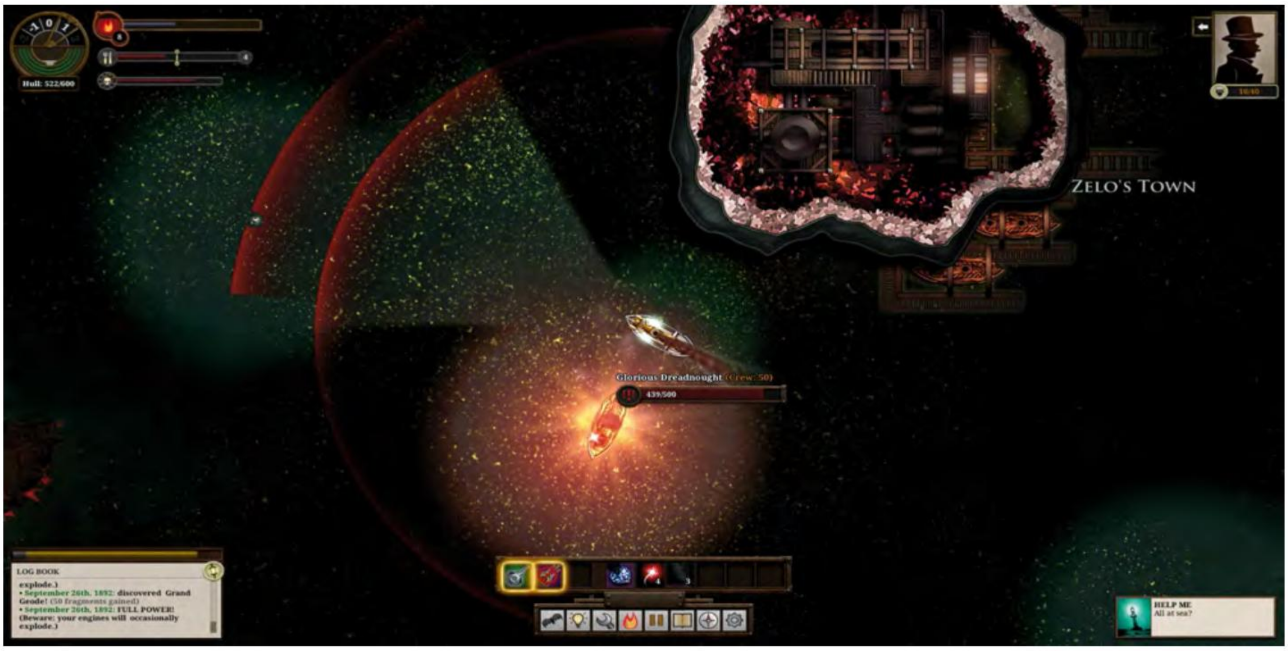
The Gothic language combines neatly with the top-down landscape.



Love can be found, even on the doomed seas.



The admiralty supplies most of your missions.



Later ships are more than capable of dealing with the threats of the sea.

faster. A high iron skill improves violence, on land and at sea. A high mirrors allows you to see better. And high hearts keeps you alive longer. It's a simple but effective way of gating your access to content.

Stories link together in unexpected ways. Picking up a strong box from a random encounter in Khan's Heart might do nothing until you happen across an island facility that's otherwise sealed. Deliver the box, and a range of other missions will unlock that tell you more about the odd semi-automata clay men, more about the world and more about your own crew. Your ship's officers, who you pick up mainly in London, but sometimes on distant shores, each have their own story, if you can wine and dine them enough to get it out. Every story is exceptionally written, with tight descriptions that evoke the strange, darkly funny subterranean world.

As you explore the Unterzee, you'll encounter the denizens of the deep and piratical types, who you can avoid or fight. Those skills we mentioned translate nicely to this, helping you avoid combat (veils), improving your damage (mirrors and iron) and health (hearts). Though the combat is simple – it can't be said that it's complex or rewarding – you swiftly work out what you can and can't defeat, and after that they become at most an annoyance, at best something to farm for resources.

THE PIRATE BAY

Any great wealth you accrue can be spent on upgrading your ship, though often it bleeds away on fuel and supplies instead (and if you run out of those, you're doomed in many interesting ways). Indeed, in the early game it can be hard to hold onto any money. Gradually, as you play, and as captains die, you work out good ways of making money – though they don't always last long. Simply travelling the sea, battling pirates and visiting old and new ports is often the best way to make a living – though everything is a risk.

Sunless Sea is, essentially, a text adventure like Failbetter's previous effort *Fallen London*, with a pretty-pretty graphical user interface and a shallow combat mechanic. The roguelike elements breadcrumb out the enjoyment from the story, the exploration of the randomised world means that it's up to you how you explore it and what you find, and the combat adds a little peril to the otherwise dull steamboat experience.

With that criticism aside, the storytelling and atmosphere alone is enough to carry the game. *Sunless Sea*'s world is so intriguing, its characters so grotesque, and its mechanics so obscure, that it's the promise of exploring unusual minds in an unusual world from an unusual perspective, which makes for an unusually enticing prospect. –**DANIEL GRILIOPOULOS**

VERDICT
8

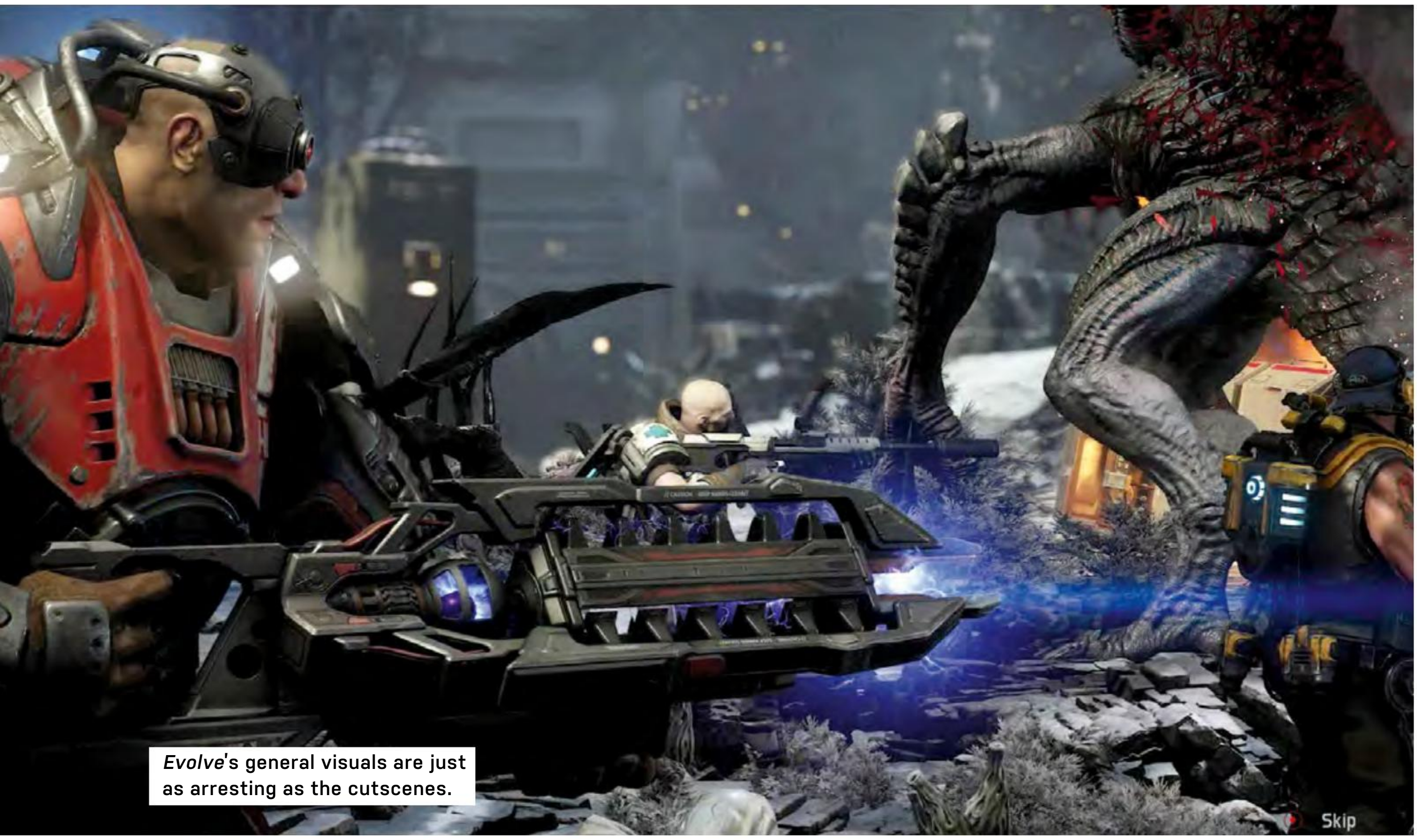
Sunless Sea

CUTLASS Stunning story snippets in an original and wonderfully weird world.

GUTLESS Dull combat married with a thematically sound but disruptive roguelike mechanic that doesn't quite fit.

RECOMMENDED SPECS DirectX 9.0c graphics card; 2GHz processor; 1GB RAM.

£14, www.failbettergames.com, PEGI: N/A



Evolve's general visuals are just as arresting as the cutscenes.

This season's must-have look: Space Marine armour and rocket launchers.

05:11
DESTROY ALL EGOS AND MINIONS

You'd be forgiven for constantly referring to it as your 'boom stick'.

Evolve

A crossbreed of co-op and competitive FPS

***EVOLVE* IS A JETPACK DANCE** between prey and predator, a multiplayer tango with ever-shifting positions. In a typical round, you go from being a frag god to fragile and back again in about 12 minutes. One moment you're a firebreathing Goliath, the next you're a fleeing, bloodied heap, scraping the map for alien wildlife to chew.

Evolve's rhythm differs between map and mode, but it's generally the tightest FPS multiplayer since *Titanfall*. For the four Hunters it's all about pursuit, with little time to plot, joke or catch your breath. That pace instills a feeling of constant urgency, but also makes it more fleeting than other multiplayers. The four-versus-one format is exactly the sort of asymmetry we need more of in the genre, but we've rarely ended up with war stories we're gagging to share, like we did with *Left 4 Dead*.

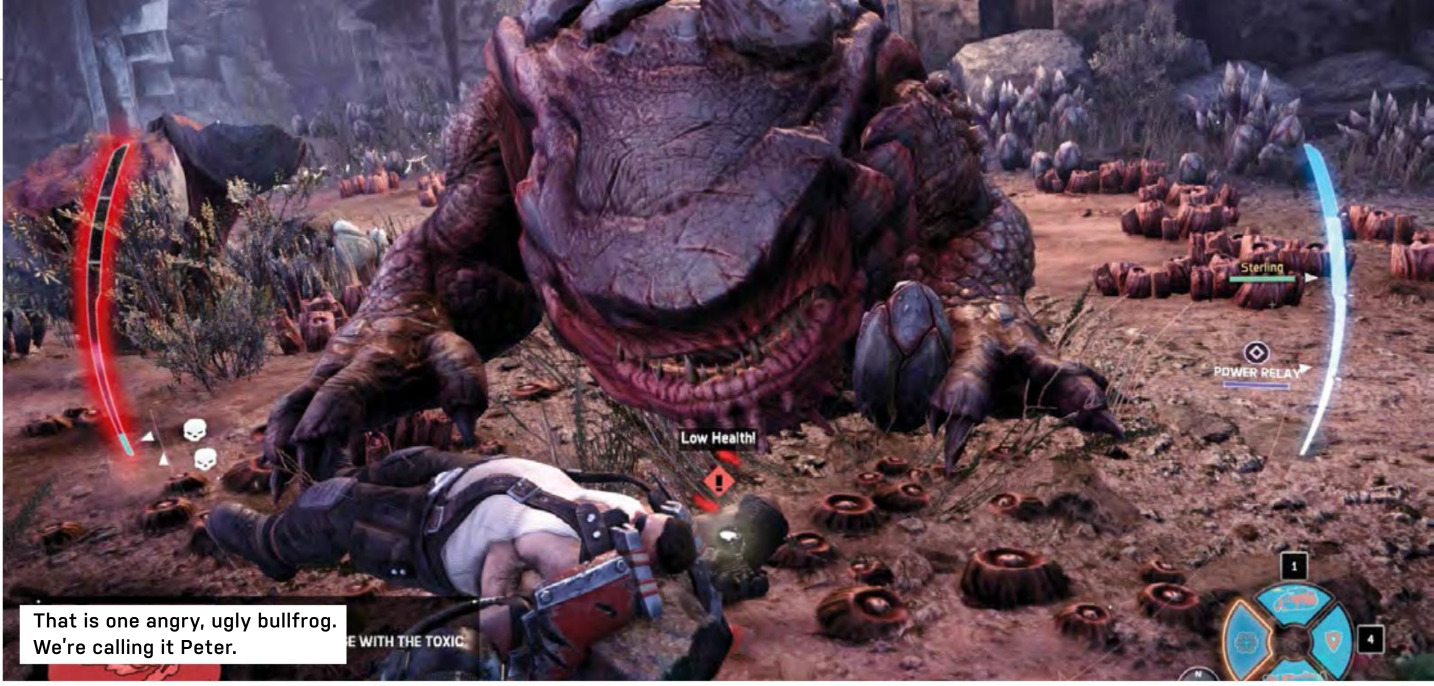
Unlike *Evolve*'s zombie ancestor, though, it's a fleshed-out competitive game, and the most ambitiously uneven entry in the genre since *Rising Storm*. Its dozen Hunters – three for each of its four classes, with more on the way as paid DLC – form a spectrum of interesting playstyles. Bucket, one of the Supports, unscrews his robot head and spits out guided missiles, while Lazarus is a medic who lets teammates die before healing them. The variety is vast.

SCI-FI SAFARI

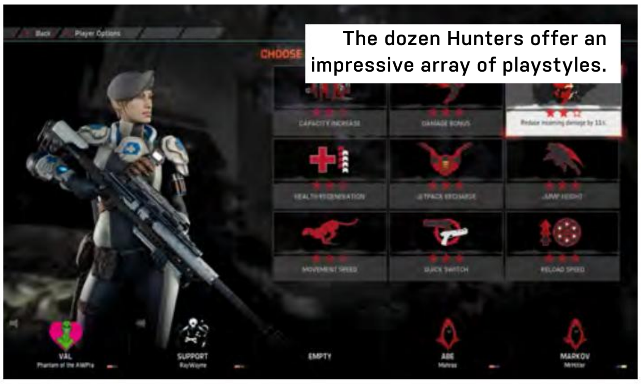
And along those lines, these weapons and abilities have their own specific skills. Developer Turtle Rock extends that "easy to learn, hard to master" virtue across most of the experience and *Evolve* benefits immensely. On both the monster and Hunter sides there's a focus on cooldown management that we like. The Hunters' jetpacks always feel starved – knowing when to conserve juice as you're trying to keep up with a beast who's straight-up quicker creates an interesting tug-of-war.

The monsters have their share of tough-but-fun movement techniques to master too. Paranoia permeates everything and that fear drives you to do anything you can to shave seconds off of your traversal time. We had a blast learning micro-skills like killing wildlife in groups so that we could slurp up their corpses quickly. The trickier skill is stealth – successfully sneaking your way through a Hunt round makes you feel like a two storey-tall ninja.

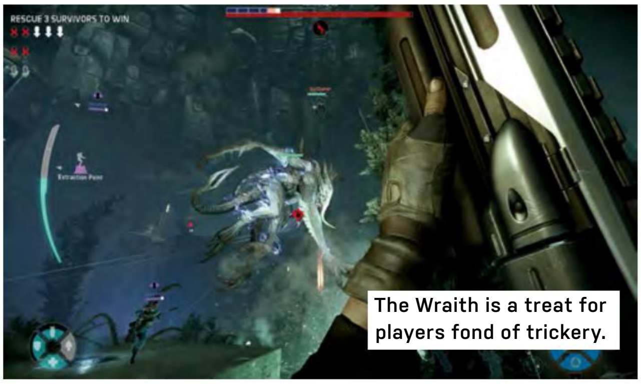
The Wraith became our favourite of *Evolve*'s aliens. Her movement style (hovering and lunging) and fragility encourages hit-and-run tactics. We loved



That is one angry, ugly bullfrog. We're calling it Peter.



The dozen Hunters offer an impressive array of playstyles.



The Wraith is a treat for players fond of trickery.

frustrating Hunters with the decoy ability, which spawns an AI-controlled mirror-Wraith – they find it brilliantly annoying.

The game is best in Evacuation, where a group plays five successive rounds on a mix of maps and modes. This format doesn't address the game's briefness, but it does form a bit of history between players and creates the opportunity for comebacks.

Other than Hunt, the three other modes within Evacuation do an okay job of stimulating different playing styles. Nest, where the Hunters have to destroy six monster eggs, is probably best. The Hunters must decide if, when, and how much to split up, a manoeuver that makes them more vulnerable but means they'll succeed quicker. Despite their simplicity, Nest, Rescue and Defend have some good tactical wrinkles, but there are also moments when they feel mundane. The objectives don't generate fun in isolation – they rely on the monster stirring up trouble.

Evolve also leans heavily on its matchmaking system. It takes coordinated Hunters to keep pace with an experienced monster, or a clever monster to challenge Hunters who know every trick. Most of our solo matches put us in satisfyingly tough games – nearly every time it felt like we were being exposed to new tactics.

We had a worse time with players of mixed skill levels. That isn't a fault of the matchmaking – *Evolve*'s balance is such that a Hunter team is only as strong as its least agile member, something to take into account if you're playing with friends.

Luckily, this is less of an issue in Evacuation, which balances the match over time. If you continue to lose, you'll get stronger. The competitive purist won't be wild about the idea, but it does make one-sided shutouts unlikely. Also, you can disable it by creating a custom match.

Our feelings about *Evolve*'s 16 maps are mixed. They're well-designed, spacious arenas, but they're also surprisingly homogeneous. The few map-specific features within them don't prompt different playstyles, something that will erode *Evolve*'s replay value.

MULTIPLAYER MAYHEM

A couple of other aspects of *Evolve*'s multiplayer structure undermine its appeal. Evacuation's voting system is odd. Between each round, the four Hunters and monster cast votes on potential combinations of map and mode. But it's an illusion of democracy as the Hunters always have a majority.

More frustrating is how easy it is for players to leave a match. The penalty is a 60-second timeout – more an invitation to nip to the toilet than meaningful discipline. Likewise, if one of your friends crashes, their spot in that match isn't reserved. On the upside, when the AI tags in, it's usually competent enough to not get you killed, but it lacks the creativity to take advantage of *Evolve*'s weird weapons and abilities.

Given how much of your time is spent chasing, it's appropriate that a night of playing feels like a series of sprints. If you lose, a rematch is a 10-minute proposition, something that counterbalances *Evolve*'s intensity. But after unlocking everything we're less motivated to keep playing. We wish Turtle Rock would've doubled-down and built a bespoke ranking system like that of *League of Legends* or *StarCraft 2*.

Evolve certainly has the depth to support such a system. Its emphasis on skillful movement and out-manoeuvering your opponent are unique. The Hunters and monsters have some of the most elegant, simple-but-deep mechanics we've laid hands on. And it's one of the best-looking games on PC, blessed with splashy particle effects, smart UI, and monsters worthy of *Pacific Rim*. But we're concerned about its longevity. It has tons of novelty, but without maps that bolster its replay value we worry about how well *Evolve*'s paid DLC and planned free map releases will keep pace with players' fatigue. **–EVAN LAHTI**

VERDICT 8

Evolve

HUNTER A refreshingly asymmetrical FPS; terrific competitive depth; looks stunning; good matchmaking system; seriously intense.

MUNTER Maps lack variety; too easy for players to abandon matches; games can feel too brief; AI bots quite predictable.

RECOMMENDED SPECS: Windows 7 64-bit; Core i7-920; 6GB RAM; Nvidia GeForce GTX 670 or ATI Radeon R9 280; DirectX 11.

£35, www.evolvegame.com, PEGI: 18

Future

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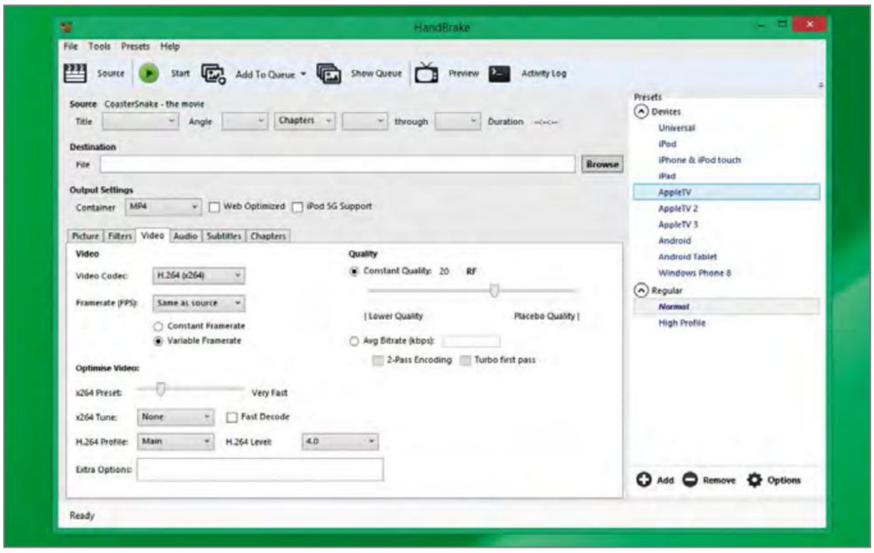
STEP-BY-STEP GUIDES TO IMPROVING YOUR PC

WINDOWS TIP OF THE MONTH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iPad
AppleTV
AppleTV 2
AppleTV 3
Android
Android Tablet
Windows Phone 8
Regular
Normal
High Profile
Add
Remove
Options
| Lower Quality
Placebo Quality |
Ready

Source CoasterSnake - the movie

Title Angle Chapters through Duration --:--:--

Destination File

Output Settings: Container MP4 ☐ Web Optimized ☐ iPod 5G Support

Video Codec: H.264 (x264)

Framerate (FPS): Same as source ○ Constant Framerate ● Variable Framerate

Quality: ● Constant Quality: 20 RF

○ Avg Bitrate (kbps): ☐ 2-Pass Encoding ☐ Turbo first pass

Optimise Video: x264 Preset: Very Fast

x264 Tune: None ☐ Fast Decode

H.264 Profile: Main H.264 Level: 4.0

Extra Options:

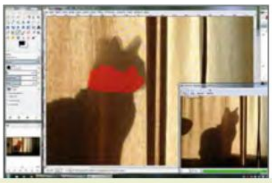
MAKE YOUR VIDEOS PLAYABLE ON ANY TYPE OF DEVICE WITH HANDBRAKE

Unless you're using Windows Vista, in which case DVD Maker will do the job, Windows doesn't come with anything for converting videos into files suitable for specific types of devices. You could download Microsoft's own Windows Movie Maker (http://bit.ly/WZlaRS), but a more lightweight and open-source alternative is Handbrake (handbrake.fr). It's strictly for converting files, and there are heaps of options for completely customising your movies.

MAKE – USE – CREATE

80
Build a LAN party gaming box

84
Set up an Instant Messenger



88
Making stunning cinemagraphs

GRAHAM BARLOW
CONTRIBUTING EDITOR

THE PRICE OF FREE

There's a big problem with Windows freeware. It's not so much the free apps themselves that are the problem – it's all the crap that comes bundled with them. Download almost anything on the top 10 most popular list from a major site like download.com, for example (as How-To Geek did here: http://bit.ly/1u0kElS), and you're inviting evil browser hijacker apps to come and have a party in your PC. And like the rude guests they are, they don't know when to leave, so they'll start disrupting the place, in this case redirecting your web searches and opening annoying pop-up windows.

You can avoid a lot of the pain by not accepting the default options when you install software you've downloaded. In most cases, you're entering a world of hurt by just hitting the 'OK' button when it asks you if you want a default install. But even so, it's not always obvious what you're agreeing to install along with your chosen app. Really, a better solution is to track down the website of the app's makers and download it direct. This way you're much less likely to be opening the floodgates to browser hijackers, but there's still no guarantee.

Here's another suggestion – stop being a cheapskate and pay for your software! We all love free software, but software with a dollar price attached means the company can make an honest living by selling it to you for a fair price, without having to install something else on your PC. When it comes to PC software, the price of free is probably too high.

↘ submit your How To project ideas to: pcfmail@futurenet.com

BUILD IT

BY TOM MCNAMARA

Assembling the Perfect LAN Party Gaming Box

LENGTH OF TIME: **2–4 HOURS** LEVEL OF DIFFICULTY: **MEDIUM**

Get some meaty gaming muscle on the go with this portable powerhouse

THE MISSION

LAST MONTH we built a portable PC featuring the Sapphire ITX Compact R9 285 – an AMD Radeon GPU which is roughly on a par with a GeForce GTX 960, but short enough to fit in an ITX case. To keep things even-handed, we're going with Nvidia this month. Our Asus GTX 970 DC Mini is at a higher tier of performance and also features twice as much VRAM. (You may have heard recently that the 970's VRAM is divided into two pools, with the smaller one performing more slowly, but it's only a few percentage points different.) AMD has the Radeon R9 290, which performs about the same as a 970, but it requires a lot more power, and there isn't one short enough to fit into an ITX case.

Generally speaking, these compact graphics cards have changed portable PC gaming a lot. Not all the systems they go into are made equal, though, so we have to survey the landscape periodically to figure out what's hot and what's not.

LAN OF OPPORTUNITY

THE COOLER MASTER HAF STACKER CASE from last month is a nice option for its modularity and low price, but we decided to go with a cube shape this time, instead of a shoebox. This makes the case easier to balance when it has an integrated handle, like we see on this Corsair Graphite 380T. Thanks to its larger dimensions in the front, the 380T can also fit a 200mm intake fan, though it ships with a 140mm unit in front (and a 120mm exhaust fan in back). You can also fit two 120mm fans on the side, or a 240mm radiator. We, of course, went with the radiator option, specifically the trusty Corsair Hydro H100i. We had one handy, and using the same brand for the CPU cooler and the case tends to cut down on incompatibility.

The 380T can fit a graphics card up to 11.4 inches long, but we preferred the shorty GTX 970 to give us some room to breathe. This plugs into an Asus Maximus VII Impact, which is a fancy ITX mobo that uses Intel's Z97 chipset. On CPU duty is the Core i7-4790K, which was the beefiest chip we could put in this mobo. Powering the whole shebang is a gold-rated Cooler Master V550. For storage, we have just a single SSD, since this unit is purpose-built for LAN gaming. The 380T will fit up to two 3.5-inch drives, though, and up to four 2.5-inch drives.

INGREDIENTS

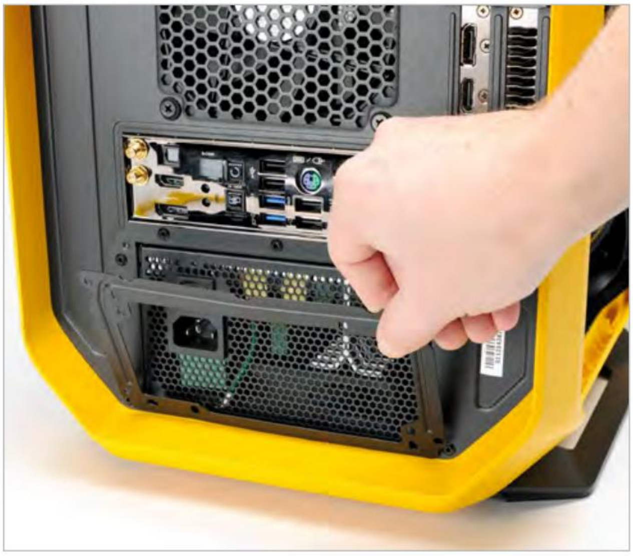
PART		PRICE
Case	Corsair Graphite Series 380T	£111
PSU	Cooler Master V550 550W	£55
Mobo	Asus ROG Maximus VII Impact	£175
CPU	Intel Core i7-4790K	£240
GPU	Asus GTX 970 DC Mini	£298
RAM	2x 8GB Corsair Vengeance Pro	£121
SSD	1TB Samsung 850 EVO	£326
OS	Windows 8.1 64-bit OEM	£73
Total		£1,399

1

METHOD TO THE MADNESS

MINI-ITX CASES, in our experience, all tend to have a number of their own little quirks and unusual deviations. Luckily, however, they generally all make sense when placed in context. This plate, for example, craftily unscrews from the back and allows you to slide in a power supply through the rear of the case. If you're wondering why, well, it's because this case doesn't have enough room to install the PSU from the side.

The 380T can take a PSU up to 180mm long, but you'll have to account for PSU cables, too, if you want to keep hold of the drive cage that's right next to it. That's why we opted for the V550 PSU, which is 140mm long – we wouldn't recommend pushing very far past 150mm. Connect your modular cables before sliding the PSU in, too, as it gets mighty cramped on the other side.

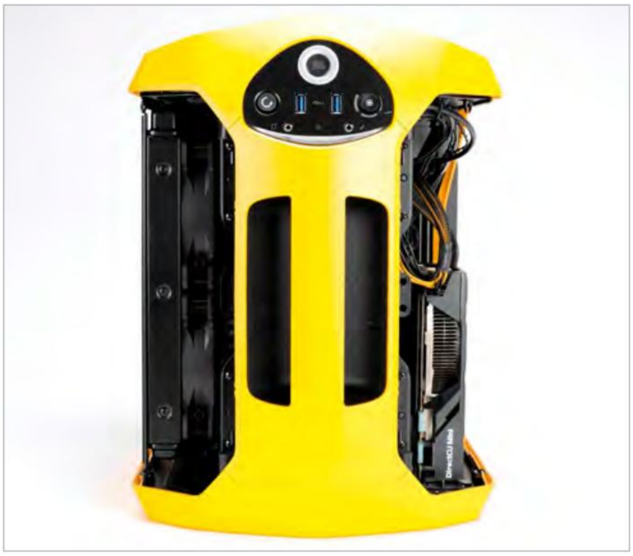


2

ROOM WITH A VIEW

THE TWO SIDE WINDOWS of the 380T come off just by pulling on their handles. As you can see from the top-down photo, though, the mobo is obscured, leading to some tactical considerations. For example, your CPU cooler must be attached to the mobo before they go in the case or you won't be able to screw down the cooler. You can get around it with a short enough screwdriver, but then you don't have much torque.

If you're using a cooler with a radiator attached, you must pull the rad through first. Our 240mm rad also barely fit lengthwise, though the case could accommodate one that's thicker than normal. For the best airflow, we'd recommend pointing the rad's fans on the inside, blowing outward and through it.



3

I'M YOUR BIGGEST FAN

TO POP OFF THE FRONT GRILL, just push its upper-left and upper-right corners until you hear them click, and it's released. The stock 140mm intake fan can be replaced with two 120mm fans or one 200mm fan – the largest option will be the quietest (though you can get high-performance fans at any size). The round holes on each corner are for threading the fan's power cable back into the case. This fan lights up with a white LED, but there's a tiny switch next to the handle in the top of the case that can toggle that off. And just FYI, there's no room in front for another radiator.

4

COOL CUSTOMERS

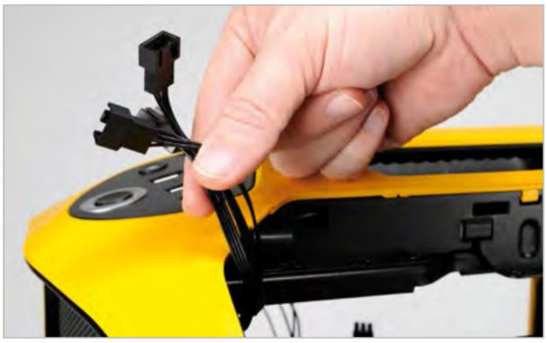
FROM THE OTHER SIDE OF THE CASE you can see just how tightly the CPU cooler's radiator is tucked in there. The tubes also have to be oriented to go into the rad on the far end of the case. If you try to orient the tubes to come out near the motherboard, they will be obstructed by the case's exhaust fan. You could remove the exhaust fan, but you'd sacrifice a lot of airflow. And we didn't notice it at first, but a partially hidden screw also allows you to remove the drive cage, so you could install a pump and a small reservoir if you wanted to do a custom water loop. You can also get pumps that integrate their own res, but a res that small also restricts how much you can cool – you'd be able to do a GPU or a CPU, but probably not both.

5

CONTROL FREAKS

YOU MIGHT WONDER how a Mini-ITX case could cost £111. One of the reasons is the integrated three-speed fan controller. In our scenario, we used this to control the front and rear fan. We could've plugged in the CPU cooler pump as well, but you want to either run that at full speed, or let it use PWM temperature measurements to regulate its own speed. So we plugged the pump into the spare motherboard fan header instead. The cable on the stock exhaust fan is plenty long enough to reach these connectors. There's a fat button on the top of the case with a fan icon on it, and you just press that to cycle through each speed setting.

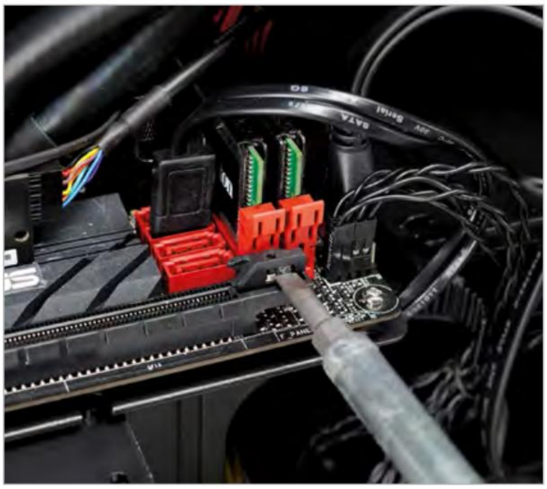
The controller itself gets juice through a SATA power connector, so make sure you've a spare before you install all your SATA-based storage devices. Our CPU cooler also uses a SATA power connector, so we'd need a second cable of that type to install more than two SATA drives.

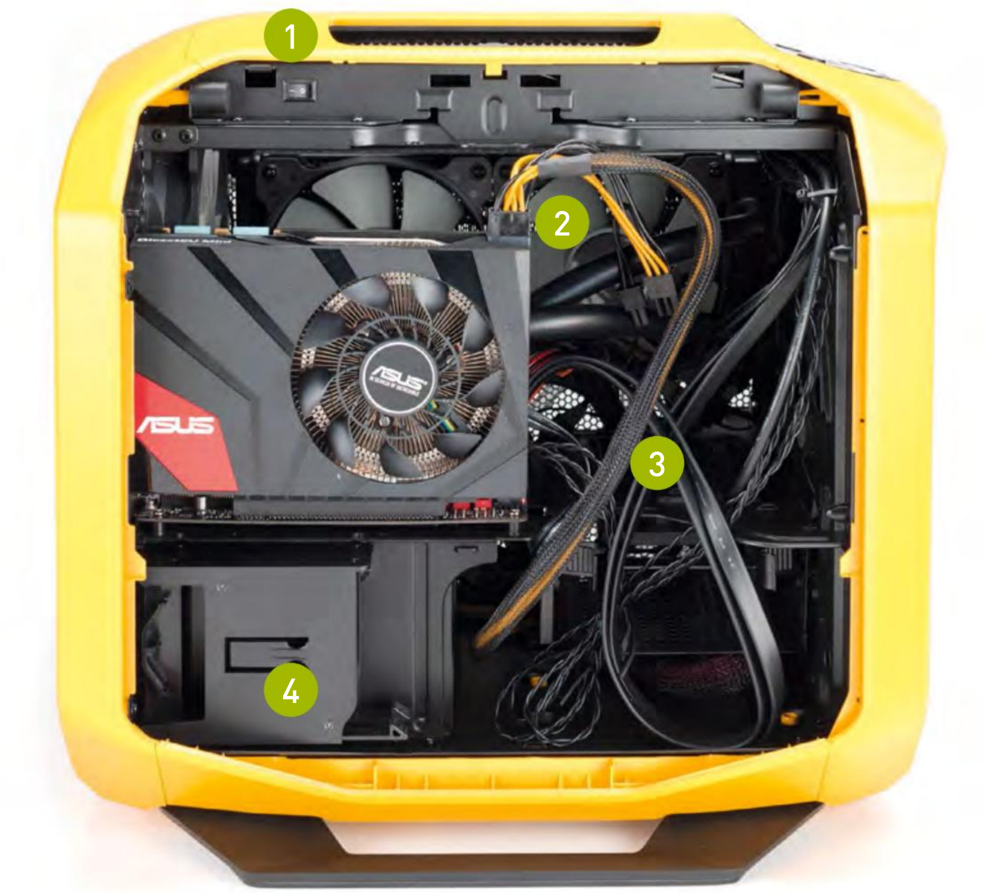


6

POPPING LOCKS

SOMETIMES THE TRICK isn't with the case, but with the hardware inside it. During the course of building a PC, especially one as unique as this one, you will often have to undo a few steps and work your way back. If you aren't familiar with this motherboard, that could prove a little challenging. Most boards use locking mechanisms on the graphics card slot to make sure the card doesn't slide out accidentally. This one has an actual spring-loaded latch with a small knob that goes through a notch in the card, rather than a lever-like handle that you can just push out of the way (usually with a spare slot cover).





① Here's the switch to turn off the LED on the front intake fan. You can't reach it from outside, but the side panel pops off easily.

② The Asus GTX 970 DC Mini needs only one 8-pin PCI Express power cable to run, so it doesn't need a fancy power supply.

③ You have nearly five inches of space between the end of this graphics card and the front of the case, so your cable routing can still be a little relaxed.

④ This is a rotated drive cage that can hold two 2.5-inch drives. We'd definitely recommend right-angle SATA data cables here.

SUNNY SIDE UP

ONE OF THE NICE THINGS about these compact ITX cases is that you can rotate and tip them very easily, both during and after the build process. The side panels on the Corsair 380T also come off with a flick of the wrist, so gaining access to any angle of the system is a breeze. Speaking of breezes, the large grills on the panels, plus the large front grill on the front and the exhaust fan on the back, make for some serious airflow. We had no trouble keeping this system ventilated.

The shorty GTX 970 graphics card did make more noise than a card of standard length, so we'd recommend a full-length card if your ears are sensitive to that. Just make sure you stay comfortably under that 11.4-inch limit.

CPU cooler height is also limited to 150mm, which will eliminate a number of tower-style air coolers from consideration. So we'd recommend a closed-loop cooler if you can afford one and are overclocking. It has to be either 120mm or 240mm, mind; the bracket doesn't fit 140mm or 280mm radiators or fans.

We also debated whether to go with an Intel Core i5 CPU or splash out on an i7. The latter is more or less an i5 with Hyperthreading. HT gives you four additional CPU threads, for a total of eight, but it's not simply like having four extra physical cores. They're more like a simulation. Still, since Direct3D 12 and Mantle let your graphics card communicate with multiple CPU threads at the same time (DirectX 11 and earlier versions only talk to one CPU thread at a time), having a lot of threads could potentially boost performance in future games, depending on how they handle this new feature.

In the end, seeing as we were already spending £1,150 on this system before we'd added the CPU, we decided that adding an extra £90 for the i7 wasn't a big deal.

Either way, you'll get to enjoy some pretty snappy performance from this system. It took well under 30 seconds to do a full reboot, which helps a lot when installing Windows, Windows updates, drivers and certain software. Our GTX 970 averaged over 80fps in *Batman: Arkham City* with 4xMSAA and everything else maxed out (though we did disable PhysX). With a whopping 4GHz base clock, our Core i7-4790K whipped through all the benchmarks like a samurai sword (on a core count basis, that is). ■

BENCHMARKS

	TEST RIG	
Premiere Pro CS6 (sec)	2,000	2,346
Stitch.Efx 2.0 (sec)	831	739 -12.5%
ProShow Producer 5.0 (sec)	1,446	1,270 -13.8%
x264 HD 5.0 (fps)	21.1	19.2 -9.8%
Batman: Arkham City (fps)	76	85
3DMark 11 Extreme	5,847	4,914 -19%

0% 5% 10% 15% 20% 25% 30% 35% 40% 45% 50%

Our benchmark results show how this month's build compared to a *PCF* test rig machine, which consists of a 3.2GHz Core i7-3930K and 16GB of Corsair DDR3/1600 on an Asus Sabertooth X79 mobo. It has a GeForce GTX 690, a Corsair Neutron GTX SSD and 64-bit Windows 7 Professional.

Set Up An Instant Messaging Service

YOU'LL NEED THIS

JAVA-ENABLED SERVER
We'll use Ubuntu and equip it with the Java Runtime Environment.

OPENFIRE SERVER
Get the open source IM server from www.igniterealtime.org.

IM CLIENT
It must support XMPP.

INSTANT MESSAGING, OR IM, is one of the best collaboration tools on any type of network. Educational institutes can use it to connect teachers with each other, as well as the students, or it can even bring together geographically displaced employees of a multinational corporation.

The Extensible Messaging and Presence Protocol, or XMPP, is one of the most popular protocols for powering an IM server – it currently serves millions of users worldwide and is also used by Google Talk. There are several XMPP-based IM servers available, but Openfire is one of the easiest to set up and use, implementing many of the commonly used functions of the XMPP protocol and scaling well. On small-scale deployments, the server can manage and support users by itself. On larger deployments, you can hook up Openfire with existing network infrastructure such as an LDAP server and offload storage to an external database server. While you can use any XMPP-compatible IM client to chat through Openfire, it works best with its own feature-rich Spark client. Here's how to set it up. –MAYANK SHARMA

1 PREPARE TO OPENFIRE

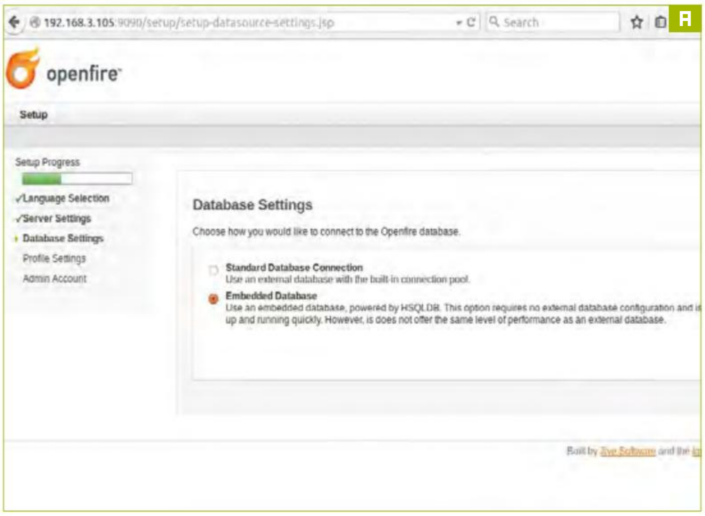
The Openfire server can be deployed on Windows, Mac OS X and on various Linux distros, including Debian, Ubuntu and Fedora. The latest version is Openfire 3.9.3. In this tutorial we'll deploy it on top of an Ubuntu Server installation.

» Before you can install Openfire, make sure your Ubuntu server has the latest Java Runtime Environment (JRE) that you can install from Ubuntu's official repository with the 'sudo apt-get install openjdk-7-jre' command. This step isn't required if you're installing Openfire on Fedora, Windows or Mac because the binaries for these platforms include the Java JRE.

2 COMMAND AND CONTROL

Once it's installed, download the .DEB binary of the latest version of the server – namely 'openfire_3.9.3_all.deb' – from its website and install it with the 'sudo dpkg --install openfire*.deb' command. That's all there is to it. The Openfire server is now installed and you can control it via the scripts that have been placed inside the '/etc/init.d' directory. You can start the server with the 'sudo /etc/init.d/openfire start' command. Similarly, to stop the server use the 'sudo /etc/init.d/openfire stop' command.

» Once the server is up and running, you can configure and control it from a remote machine via its browser-based interface, which you can access by pointing your web browser to port 9090 on your server. For example, if the Openfire server is on a machine with the IP address 192.168.3.100, then Openfire's web interface is at http://192.168.3.100:9090.



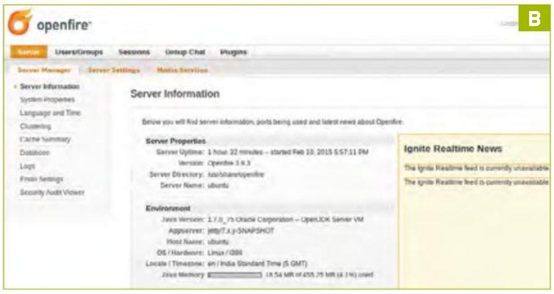
192.168.3.105:9090/setup/setup-datasource-settings.jsp

Database Settings

Choose how you would like to connect to the Openfire database.

○ **Standard Database Connection**
Use an external database with the built-in connection pool.

● **Embedded Database**
Use an embedded database, powered by HSQLDB. This option requires no external database configuration and is up and running quickly. However, is does not offer the same level of performance as an external database.



Server Information

Below you will find server information, ports being used and latest news about Openfire.

Server Properties
Server Uptime: 1 hour 32 minutes – started Feb 10, 2015 5:57:11 PM
Version: Openfire 3.9.3
Server Directory: /usr/share/openfire
Server Name: ubuntu

Environment
Java Version: 1.7.0_75 Oracle Corporation – OpenJDK Server VM
Appserver: jetty/7.x.y-SNAPSHOT
Host Name: ubuntu
OS / Hardware: Linux / i386
Locale / Timezone: en / India Standard Time (5 GMT)

3 CONFIGURATION WIZARD

The first time you bring up the interface, you'll be taken through a five-step configuration wizard to set up Openfire. After selecting the language, you'll be asked to tweak basic server settings such as the domain name. You should also change the default ports for accessing the administration console. For added security you can also encrypt system properties by selecting one of the two encryption algorithms offered (Blowfish and AES) and specifying a key.

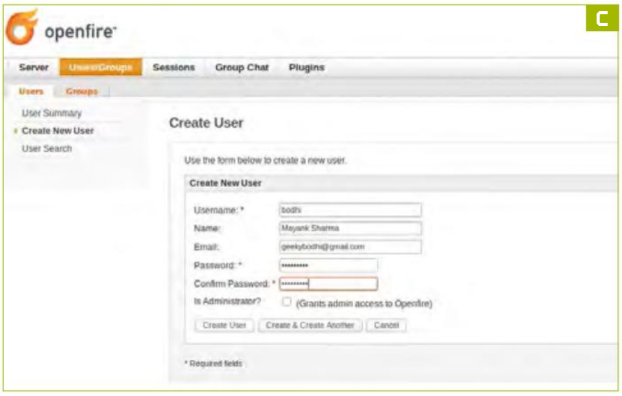
» In the next step you're asked to select a database for storing information such as user profiles and offline messages [Image A]. If you're deploying Openfire on a small network, you can choose to use the built-in HSQLDB, which doesn't require you to set up an external database server. However, if you'll be servicing hundreds of users concurrently, you should select the option to connect to an external database such as MySQL.

4 USER MANAGEMENT

In the following step you're asked to select a mechanism for fetching user authentication information. Unless you've a directory server already managing users, you should use the default option which entrusts user management to Openfire.

» In the final step you're asked for the email address of the administrator along with the password for accessing the admin interface on subsequent visits. Your Openfire server is now ready to accept connections and facilitate communications inside your network.

» If you haven't changed the port of the admin interface, you can manage the server by heading to the same address as before. Instead of the configuration wizard, you'll be greeted by a login page. Enter the username (admin) and the password you specified in the last step of the configuration wizard to access Openfire's admin interface [Image B].



Use the form below to create a new user.

Create New User

Username: * bodhi
Name: Mayank Sharma
Email: geekybodhi@gmail.com
Password: * ••••••••••
Confirm Password: * ••••••••••
Is Administrator? ☐ (Grants admin access to Openfire)

* Required fields

5 INTERACTING WITH THE SERVER

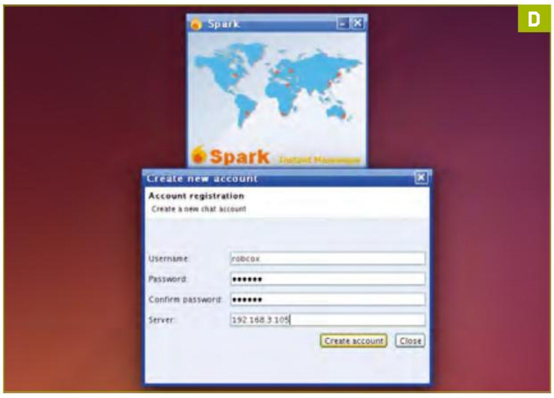
Now the server's set up, you can connect to it using an IM client from any computer on the network. Like Openfire, its companion Spark client is also available for multiple platforms and distros, including Windows and Mac OS X. For Ubuntu, you'll have to download the latest version as a compressed tarball and extract it with the 'tar xvf spark_2_6_3.tar.gz -C /opt' command. There's no installation and once it's extracted you can launch the client with the '/bin/bash /opt/spark/Spark' command.

» Spark requires 32-bit Java, so if you're on a 64-bit machine and get errors about missing libraries you can install them individually, or you can install 32-bit JDK with 'sudo apt-get install openjdk-7-jdk:i386'. In the client, enter the login credentials of the admin user and enter the IP address of the Openfire server in the Server field, and click on the 'Login' button.

» You can also connect to Openfire using other multi-protocol IM clients such as Pidgin. In addition to the login credentials and the IP address of the server, you'll also have to make sure the client uses the XMPP protocol to connect to Openfire.

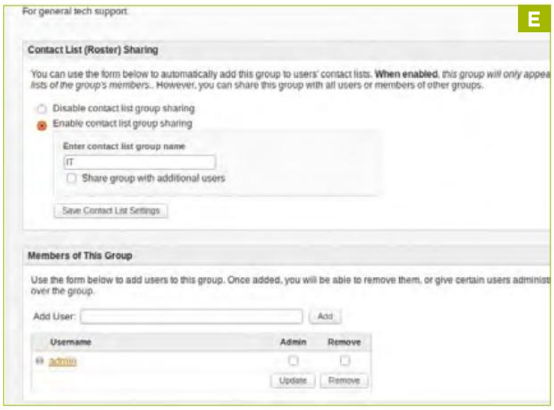
6 POPULATE ROSTERS

At the moment, your contacts list is empty because there aren't any users on the server besides you, the administrator. There are two ways you can add users – either via the web-based administration console or from within Spark. If you prefer the first route, head to the 'Users/Group' tab. To create a new user click on 'Create New User' and fill out their details [Image C]. To better organise users you can also categorise them under different groups. To define groups, switch to the 'Groups' tab and click on 'Create New Group'. Users can also register themselves with the Openfire server from the Spark client by clicking on the 'Accounts' button and filling out their desired login details [Image D].



Account registration
Create a new chat account

Username: robcox
Password: ••••••
Confirm password: ••••••
Server: 192.168.3.105



For general tech support

Contact List (Roster) Sharing

You can use the form below to automatically add this group to users' contact lists. **When enabled**, *this group will only appea* *lists of the group's members.*. However, you can share this group with all users or members of other groups.

○ Disable contact list group sharing
● Enable contact list group sharing

Enter contact list group name
IT
☐ Share group with additional users

Members of This Group

Use the form below to add users to this group. Once added, you will be able to remove them, or give certain users administ over the group.

Add User:

Username	Admin	Remove
admin	☐	☐

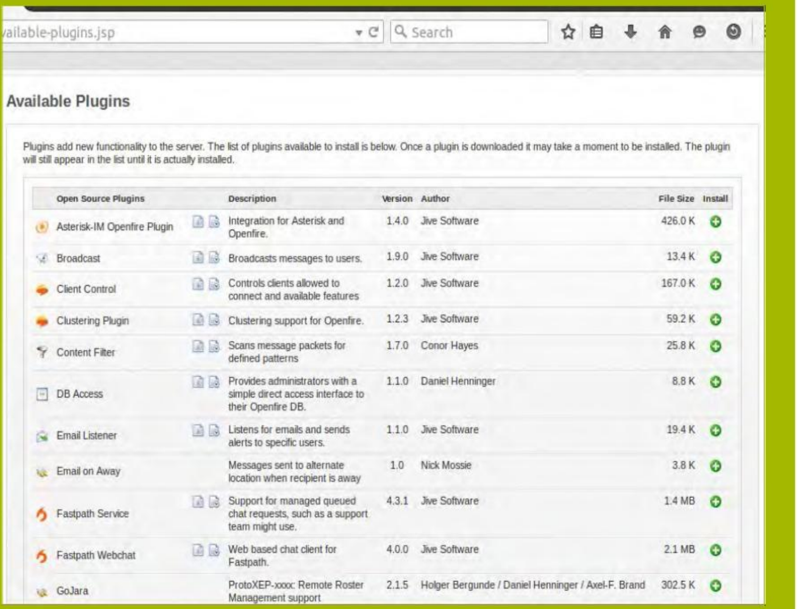
» Once you've added users and defined groups, you can use this information to populate their rosters. A roster in XMPP parlance is a friends list. With Openfire's roster

UPGRADE WITH PLUGINS

While it's loaded with features, you can extend Openfire and infuse new functionality by adding plugins. The default Openfire installation ships with over 20 plugins that have been thoroughly tested.

There are plugins that add useful features such as the ability to broadcast messages to all users and to filter messages based on their content. Then there are plugins that help hook up Openfire to existing services on the network, such as the Asterisk PBX or an email server. When connected to an email server, Openfire will alter users on any incoming emails. One interesting plugin we've used in this tutorial is 'Kraken IM Gateway'. It helps users connect to public IM services such as Facebook and Google Chat.

To enable a plugin, log into the web admin console and head to 'Plugins → Available Plugins' to view the list of all supported plugins. Each one has a brief description and buttons to view its 'readme' file and 'changelog'. To install a plugin simply click the green '+' button next to it.



Available Plugins

Plugins add new functionality to the server. The list of plugins available to install is below. Once a plugin is downloaded it may take a moment to be installed. The plugin will still appear in the list until it is actually installed.

Open Source Plugins	Description	Version	Author	File Size	Install
Asterisk-IM Openfire Plugin	Integration for Asterisk and Openfire.	1.4.0	Jive Software	426.0 K	⊕
Broadcast	Broadcasts messages to users.	1.9.0	Jive Software	13.4 K	⊕
Client Control	Controls clients allowed to connect and available features	1.2.0	Jive Software	167.0 K	⊕
Clustering Plugin	Clustering support for Openfire.	1.2.3	Jive Software	59.2 K	⊕
Content Filter	Scans message packets for defined patterns	1.7.0	Conor Hayes	25.8 K	⊕
DB Access	Provides administrators with a simple direct access interface to their Openfire DB.	1.1.0	Daniel Henninger	8.8 K	⊕
Email Listener	Listens for emails and sends alerts to specific users.	1.1.0	Jive Software	19.4 K	⊕
Email on Away	Messages sent to alternate location when recipient is away	1.0	Nick Mossie	3.8 K	⊕
Fastpath Service	Support for managed queued chat requests, such as a support team might use.	4.3.1	Jive Software	1.4 MB	⊕
Fastpath Webchat	Web based chat client for Fastpath.	4.0.0	Jive Software	2.1 MB	⊕
GoJara	ProtoXEP-xxxx: Remote Roster Management support	2.1.5	Holger Bergunde / Daniel Henninger / Axel-F. Brand	302.5 K	⊕

You can also download a handful of beta plugins from Openfire's website.

sharing feature, all your users will have their co-workers already in their contact list as soon as they log in. You'll need a categorised list of groups and users for this feature to work. It doesn't matter whether you've got this information from a directory server or have created it manually in the admin interface.

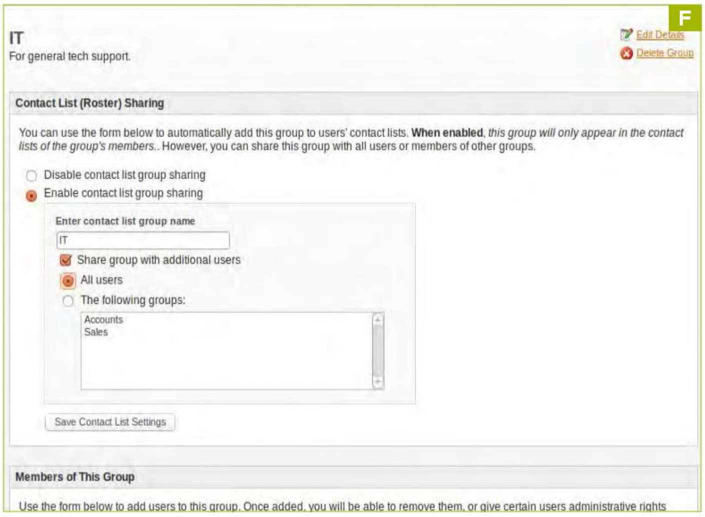
7 SHARING CONTACTS

To allow members of each group to see each other, log in to the web interface and head to the 'Users/Groups' section. Switch to the 'Groups' section and select any group from the list. This opens the page for editing the settings of that particular group. Scroll down to the 'Contact List (Roster) Sharing' section and toggle the 'Enable' contact list group sharing option, then enter the name of the group in the text box [Image E]. Now save the settings and repeat the procedure for all the groups on your server. Once you're done, members of a group will automatically have each other in their contact list.

» Additionally, there are certain users, for example the guys from the IT department, who you might want in everyone's roster. To do this, enable roster sharing for them just like above. But before saving the settings, toggle the 'Share' group with additional users checkbox and select the 'All users' option [Image F]. Now all users in every group will have users from IT in their contact list.

8 ADDING OTHER IM NETWORKS

By default the Openfire server facilitates communication between users registered with it. But you can also interact with users on other public IM networks such as Yahoo, Facebook and Google Talk. For this functionality, you need to enhance Openfire by adding the 'Kraken IM Gateway' plugin that allows Openfire users to connect to their accounts on external services.



IT
For general tech support.

Contact List (Roster) Sharing

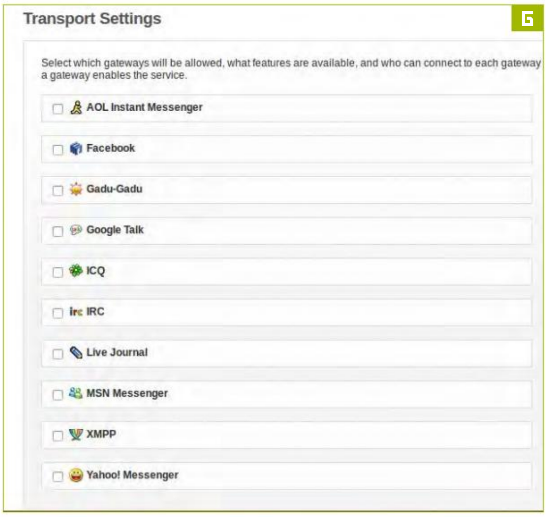
You can use the form below to automatically add this group to users' contact lists. **When enabled**, *this group will only appear in the contact lists of the group's members.*. However, you can share this group with all users or members of other groups.

○ Disable contact list group sharing
● Enable contact list group sharing

Enter contact list group name
IT
☑ Share group with additional users
● All users
○ The following groups:
Accounts
Sales

Members of This Group

Use the form below to add users to this group. Once added, you will be able to remove them, or give certain users administrative rights



Transport Settings

Select which gateways will be allowed, what features are available, and who can connect to each gateway a gateway enables the service.

☐ AOL Instant Messenger
☐ Facebook
☐ Gadu-Gadu
☐ Google Talk
☐ ICQ
☐ IRC
☐ Live Journal
☐ MSN Messenger
☐ XMPP
☐ Yahoo! Messenger

» Begin by installing the plugin (see "Upgrade With Plugins", opposite). Once installed, the plugin creates its own entry called 'Gateways' under the 'Server' section in the web admin panel.

» Using it is straightforward. To allow users to connect to a third-party IM server, head to 'Gateways → Transports'. This section lists all the supported IM services [Image G]. When you select a service it slides open a small bar at the bottom with three buttons that'll help you configure and test the gateway. You can access some settings specific to a gateway using the 'Options' slider button. However, unless you're having trouble connecting, the default settings should work without any modifications. You can test the settings using the 'Tests' slider button.

9 SETTING PERMISSIONS

By default, all users on the Openfire server will be able to connect to the enabled gateway service. To restrict access to certain users or a particular group, you need to head to the 'Permissions' option. Here you get options to choose the users and groups you wish to connect to external services. You can also restrict the gateway to only users you've added manually.

» You can enable as many different gateways as you wish to choose, with different permission settings for each. For example, you can enable Google Talk for all users and IRC for just the IT group. Icons for enabled services appear in the user's Spark client. They can then click on the icon and enter the login credentials for the service to connect to it. ■

PUT INTO PRODUCTION

There's a couple of things you should keep in mind when you're ready to roll Openfire out into a live production environment. You'll have to tweak your firewall, for example, to allow Openfire traffic.

In addition to the admin console that runs on port 9090, there are some other ports that Openfire uses to facilitate communication. These include port 5222, which the client uses to connect to Openfire, and port 7777, which is used for file transfers. All ports used by the server are listed on the main page of the web admin console.

If you're running an external database server you should use it instead of the database for greater performance. Create a database for Openfire in your database server and then populate it by using the appropriate database schema from under the Openfire installation (/usr/share/openfire/resources/database/). Openfire ships with database schemes for several databases, such as IBM's DB2, PostgreSQL, Microsoft's SQL Server and more.

You'll also want to connect the Openfire server to a directory server such as OpenLDAP, if you've one running on your network. You need to know the hostname or IP address and the port of the machine the directory server is running on, its BaseDN, and the authentication information.

You should then re-run the Openfire setup wizard by editing the '/etc/openfire/openfire.xml' file and changing '←setup→false←/setup→' to '←setup→true←/setup→'. Now select the Directory Server button in the profile settings step and enter your server's details. Once Openfire connects, you can pick the elements used to populate the user's IM profile.

Record Skype Calls On Your PC

YOU'LL NEED THIS

PAMELA
An easy-to-use app that works well with Skype. Download it for free from www.pamela.biz.

SKYPE IS AN AMAZING TOOL, but it's missing a few features – most significantly the ability to record your conversations and video chats. Call recording can be enormously useful for video conferencing, seminars and interviews – in other words, basically any situation where you need to keep a note of what's being said, but want to listen and participate rather than keeping your head down and scribbling in a notepad.

In the UK, the Regulation of Investigatory Powers Act (RIPA) permits you to record your own communications provided the recording is for your own use. You can't make a recording and share it with someone who wasn't part of the original call. For more information, visit bit.ly/1oJOvWa. You don't have to let people know that you're going to record them, but it's good manners to do so anyway. –CAT ELLIS

1 GET THE RIGHT SKYPE

Make sure you have the latest version of Skype for Windows Desktop installed (Pamela won't work with the Windows 8 modern app). You can get the right version by visiting www.skype.com and clicking the green button in the centre of the page, then selecting 'Get Skype for Windows Desktop'. Follow the instructions to download and install. Log in using your Skype or Microsoft account.

2 MEET PAMELA

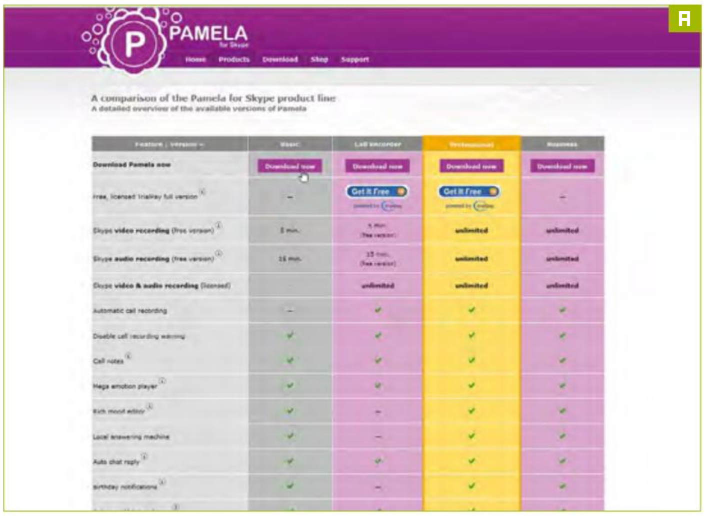
Now visit www.pamela.biz and click 'Products' (don't choose the 'Download' link from the homepage). The Products page lists various versions of the software, but the free Basic edition offers everything we need, so click 'Download now' in the grey column on the left [Image A]. You can always upgrade later if you decide you want more features.

3 INSTALL THE APP

Click 'Save file', then click your web browser's 'Download' button and select it. Choose a language, then follow the on-screen instructions to install Pamela. At the end of the installation, you'll be asked if you want to see some special promotions – click 'No'. You can now use the new icon on your desktop to open the program, ready to record.

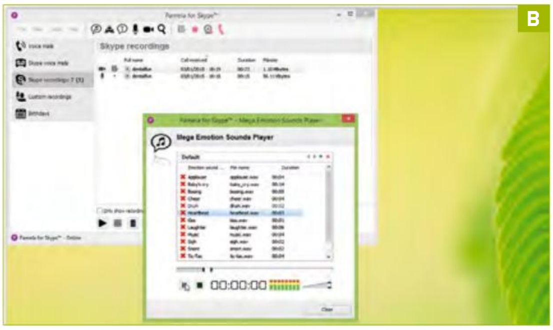
4 SKYPE, MEET PAM

Once you've opened Pamela, fire up Skype for Desktop. Skype will detect Pamela and display a message at the top of the window offering to show you how third-party apps work with Skype. The next time you make or receive a Skype call, Pamela will ask if you want to record (video or just audio). Use the buttons in the menu bar to start, pause or end recording.



A comparison of the Pamela for Skype product line
A detailed overview of the available versions of Pamela

Feature | Version →	Basic	Call recorder	Professional	Business
Download Pamela now	Download now	Download now	Download now	Download now
Free, licensed TrialPay full version	–	Get it Free	Get it Free	–
Skype video recording (free version)	5 min.	5 min. (free version)	unlimited	unlimited
Skype audio recording (free version)	15 min.	15 min. (free version)	unlimited	unlimited
Skype video & audio recording (licensed)	–	unlimited	unlimited	unlimited
Automatic call recording	–	✓	✓	✓
Disable call recording warning	✓	✓	✓	✓
Call notes	✓	✓	✓	✓
Mega emotion player	✓	✓	✓	✓
Rich mood editor	✓	–	✓	✓
Local answering machine	✓	–	✓	✓
Auto chat reply	✓	✓	✓	✓
Birthday notifications	✓	–	✓	✓


B
Pamela for Skype
Skype recordings
Pamela for Skype – Mega Emotion Sounds Player
Mega Emotion Sounds Player
Default
00:00:00
Close

5 TAKE A NOTE

Pamela includes lots of functions to help you make the most of your recordings. For example, if you click the notepad icon at the bottom of the window, you can add notes to help you refer back to them in future – ideal if you're recording meetings or seminars. You can use the buttons at the bottom to initiate a Skype chat with the person you recorded, or start a new call.

6 MAKE SOME NOISE

It's not all work though – Pamela has some fun functions built in too, including an audio equivalent of the emoticons used to express feelings in text messages [Image B]. Click the speech bubble containing a musical note in the top menu bar and you'll see a list of sound effects that you can play during a call. Be careful though – many of them could be interpreted as sarcastic!

7 TALK TO YOURSELF

If you just want to record your own voice (to dictate notes while you work, for example), click the microphone icon in Pamela's top menu bar to activate Custom Recording. This will record audio from your PC's microphone, but with the advantage that you can add notes and file it away. You can also record video footage from your own webcam by clicking the camera icon.

8 GO DEEPER

Congratulations, you've added a much-needed function to Skype's already impressive feature set, making it even better for video conferences, meetings and just chatting with friends and family. Pamela also includes 'enhanced mood' functions, plus a few other surprises, so check out the help files to see how much more it can do. ■

Make Your Own Cinemagraphs

YOU'LL NEED THIS

GIMP 2.8
GIMP is rough around the edges but surprisingly powerful. Get it for free at www.gimp.org.

CAMERA AND TRIPOD
Anything that shoots video will do, from your phone to a high-end DSLR.

TRADITIONAL ANIMATED GIFS are all well and good, but there's a newer, much classier kid on the block. Cinemagraphs are still animated GIFs, but with a more artistic, photographic twist. A good cinemagraph resembles a still photograph, with just a small part of it animated. It's a fantastic way to draw the viewer's attention to a certain area of the image, or to surprise them when an apparently still picture comes briefly and unexpectedly to life. You can see some great examples here: http://bit.ly/1MiF1AD.

Fortunately, making cinemagraphs is pleasingly straightforward, so we're going to show you how to do it using GIMP 2.8. If you have Photoshop then don't feel left out, because the workflow is almost identical – just use Photoshop's 'Video frames to layers' option and then use the Photoshop equivalents of the editing techniques we use here. It's all fairly basic stuff, but the results can be phenomenal. –JIM McCAULEY

1 GET SOME VIDEO

First up, we need some video to work with. If you're going to shoot your own, then there are a few rules to observe. Always use a tripod (because you need your video to be rock-steady), and frame and compose your shot as if you're taking a photograph. And, of course, make sure your video features some movement.

2 GIVE IT A TRIM

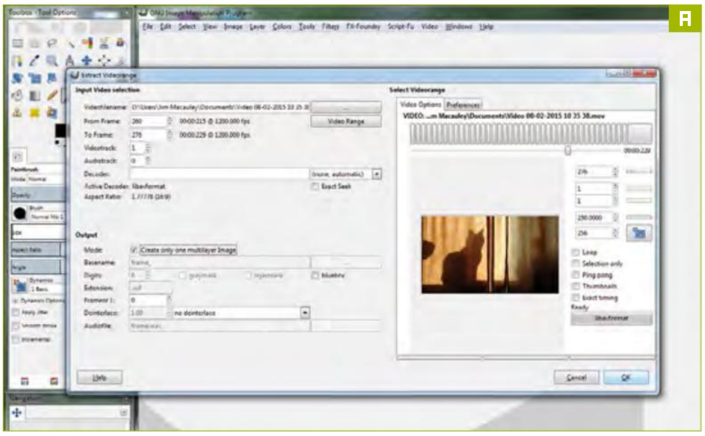
Your footage probably needs a bit of a trim. We've used Avidemux – http://fixounet.free.fr/avidemux/ – because it's free and gets the job done. You open up your video, set an 'in point' and an 'out point' and save. You might also want to use it to reduce the saturation so that your cinemagraph still looks good when reduced to 256 colours, in which case be sure to set the Video Output option to something other than 'Copy'. We're using H264.

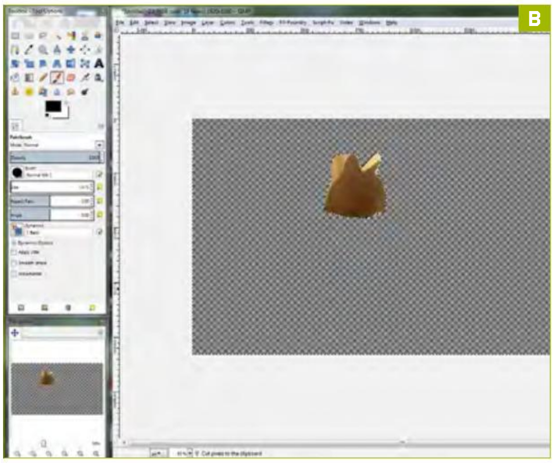
3 INSTALL GAP

We'll need to install the GIMP Animation Pack before we can import video. You can find it here: http://bit.ly/1zZKeqB. Click the blue 'Download' link in the right-hand column. Unzip it, run the installer and unpack everything to a handy folder. You'll then need to copy everything from '/lib/gimp/2.0/plugins' to your GIMP plugins folder, probably 'C:/users/←your username→/.gimp-2.8/plug-ins'. Then copy everything from '/share/gimp/2.0/scripts' to 'C:/users/←your username→/.gimp-2.8/scripts'. Once that's done, start up GIMP and marvel at the new Video menu.

4 IMPORT YOUR VIDEO

Now the fun can begin. Go to 'Video → Split Video into Frames → Extract Videorange' and load your footage, then click 'Video Range' to comb through your clip, frame by frame, so you can import video frames as layers. Find a good start and end frame (you'll want to make sure that the two frame match up visually), and enter their numbers in 'From Frame' and 'To Frame'. Set Audiotrack to '0' (because we don't want any audio) and under Output, tick 'Create only one multilayer image'. Finally, click 'OK' to import your frames [**Image A**].


A
File Edit Select View Image Layer Colors Tools Filters FX-Foundry Script-Fu Video Windows Help
Extract Videorange
Input Video selection
Videofilename:
From Frame:
To Frame:
Videotrack:
Audiotrack:
Decoder:
Active Decoder:
Aspect Ratio:
Video Range
Exact Seek
Output
Mode:
Create only one multilayer Image
Basename:
Digits:
Extension:
Framenr 1:
Deinterlace:
no deinterlace
Audiofile:
Select Videorange
Video Options
Preferences
Loop
Selection only
Ping pong
Thumbnails
Exact timing
Ready
Help
Cancel
OK



5 ANIMATION BASICS

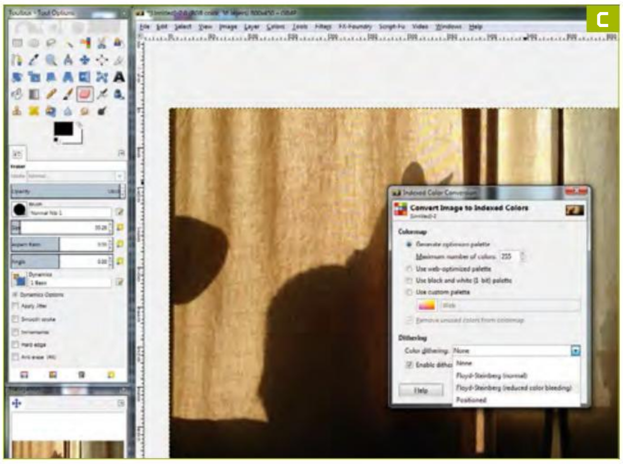
All being well, you should now have a stack of frames in your Layers panel that'll make up the basis of your animation, running from bottom to top. You'll notice that by each frame's name is a time in brackets. This is the length that each frame will be displayed in milliseconds. You can double-click and edit this length to make frames appear for longer or shorter amounts of time.

6 FRAME PREPARATION

Make your top layer invisible and set the bottom layer to visible; this is the base layer of your cinemagraph and will form the static backdrop for the animation. Now you'll need to work through all the other frames, right-clicking and selecting 'Add Alpha Channel', for reasons that will become clear in a bit.

7 MASK THE ACTION

If you haven't already done so, you now need to decide which bit of your cinemagraph you want to be animated. Got it? Good. Hit [CTRL] + [A] to select all, press the 'Quick Mask' button in the bottom right-hand corner, then use the Paintbrush tool to paint over the animated area. You should then work through the other layers,


C
Indexed Color Conversion
Convert Image to Indexed Colors
Colormap
Generate optimum palette
Maximum number of colors: 255
Use web-optimized palette
Use black and white (1-bit) palette
Use custom palette
Remove unused colors from colormap
Dithering
Color dithering: None
Enable dithering
None
Floyd-Steinberg (normal)
Floyd-Steinberg (reduced color bleeding)
Positioned
Help

making them visible in order to add bits where the animation has moved outside of the mask.

8 TRIM THE EXCESS

You'll now have a mask that covers the full extent of the animation. Click the 'Quick Mask' button again to create a selection, and work through all the layers except the background, pressing [CTRL] + [X] to delete the static area from each frame.

This is when you'll realise if you've forgotten to add that alpha channel. Without it, you'll turn the deleted area white instead of transparent [Image B].

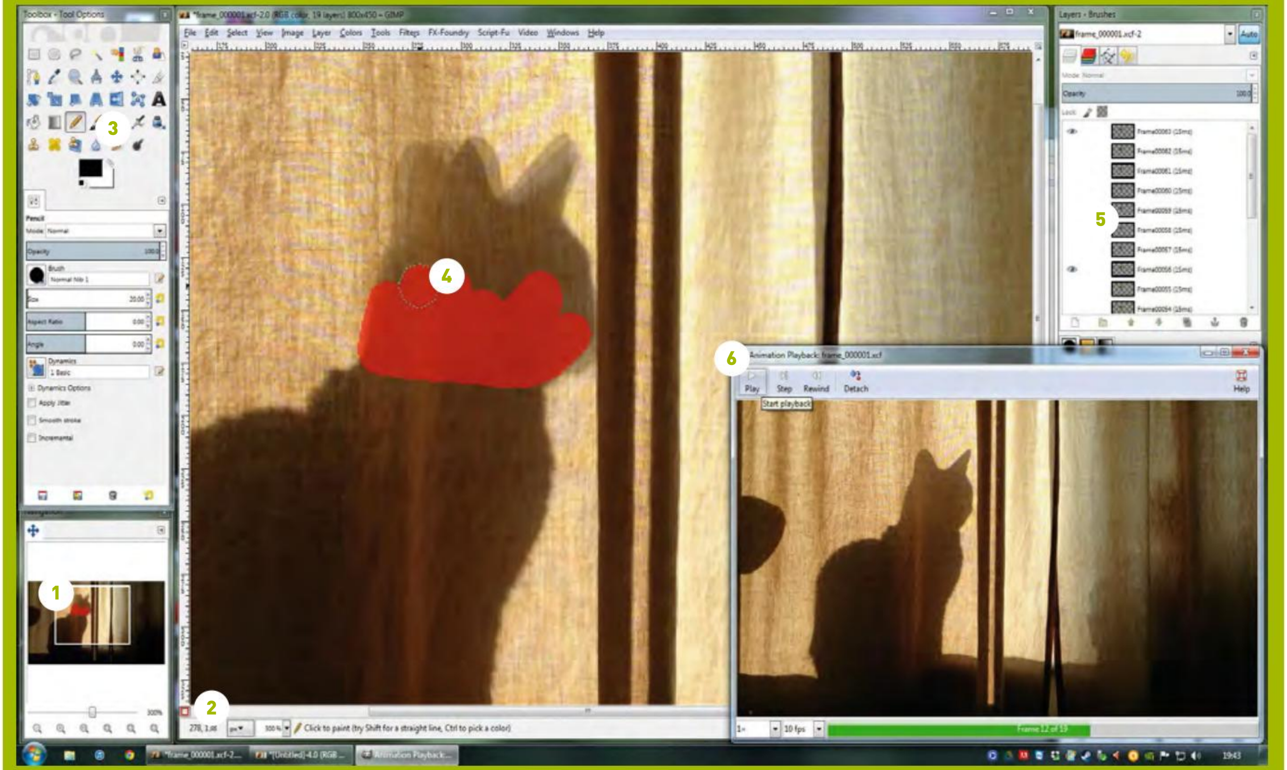
9 FINE TUNING

Make sure all the layers except the background are invisible, then select 'Filters → Animation → Playback' to preview your cinemagraph. Doesn't loop smoothly? Try making it play backwards and forwards using this Mirror Layers script: http://bit.ly/1DLiDT0. Or, for a smooth animation, try pasting the first frame into the last few frames at an increasing amount of opacity.

10 EXPORT YOUR CINEMAGRAPH

Now to finish off. Resize your image to something between 600 and 800 pixels wide, so it's not an enormous file. Go to 'Image → Mode → Indexed', select 'Generate optimum palette', and use some form of dithering, probably 'Floyd-Steinberg (reduced color bleeding)', but try them all and see what works best [Image C]. Check 'Enable dithering of transparency', hit 'Convert'. Then select 'File → Export', and save your animation as '←filename→.gif', making sure you tick 'As animation' before you hit 'Export'. And that's it. You can now see your cinemagraph in action by simply dragging the file into a web browser. ■

ON THE MOVE


1
2
3
4
5
6
frame_000001.xcf-2.0 (RGB color, 19 layers) 800x450 – GIMP
Toolbox - Tool Options
Layers - Brushes
Animation Playback: frame_000001.xcf
Play
Step
Rewind
Detach
Help
Start playback
10 fps
Frame 12 of 19
Click to paint (try Shift for a straight line, Ctrl to pick a color)

1. NAVIGATION
GIMP's navigation window provides an easy way to move around your image and zoom in on details if you need to work close up.

2. QUICK MASK BUTTON
You might be used to the Lasso tool, but the Quick Mask is ideal for creating odd-shaped selections that would otherwise require loads of fiddly clicking.

3. DRAWING TOOLS
We're not doing any actual drawing. Instead we're using the drawing tools to create our mask, it's quick and precise and you can fine-tune with the eraser.

4. MASK
Here we're masking out the part of the cinemagraph we want to be animated. We'll then delete everything else in each of the frames.

5. LAYERS
These layers form each frame of your animation. You can adjust the timing of each one by simply editing the number in brackets.

6. PLAYBACK
Check how your cinemagraph is coming along with the playback window. Play, adjust and play again until you're completely happy.

Make Your Desktop A Thing Of Beauty

YOU'LL NEED THIS

RAINMETER
Download the desktop customisation tool for free from rainmeter.net.

THE WINDOWS INTERFACE might be nice enough, but we all have different ways of working. Rainmeter is a powerful yet easy-to-use system that enables you to customise your Windows desktop with widgets that display to-do lists, calendars, weather, system statuses and other useful information.

If you want something quick and easy, then you can simply install and customise a ready-made suite. If you want more, you can hunt around for the perfect skin combination to create your own unique setup.

There are two main reasons to use Rainmeter – beauty and function. A community has grown up around the software and many people have created stylish suites that are available to download and use for free. Once you've transformed the aesthetic of your desktop, you can add the functionality that fits your way of using your computer. –TANYA COMBRINCK

1 DOWNLOAD RAINMETER

Point your browser at rainmeter.net, click the download link under 'Final Release' and run the installer. You can then choose the standard installation. It's best to leave the default options in place unless you have a very old PC, in which case you should choose '32-bit'.

2 LEARN YOUR WAY AROUND

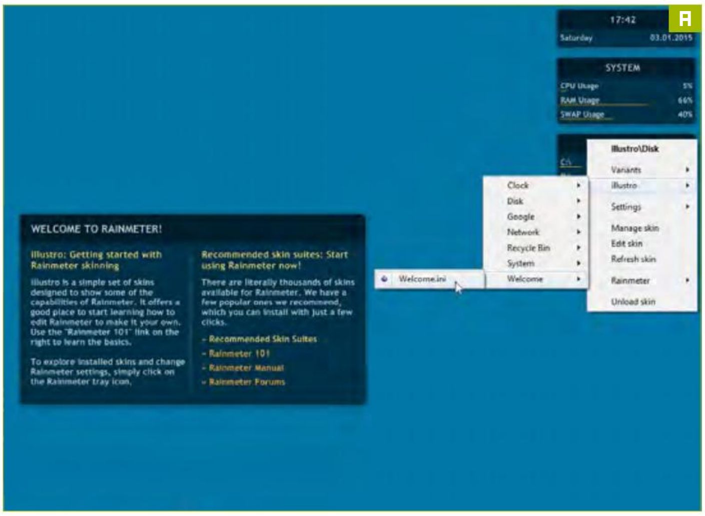
The first things you'll see are a few simple skins on your desktop from the 'illustro' suite. There's a clock, some system monitors and a welcome skin. To get rid of the welcome skin, simply right-click on any skin and choose 'illustro → Welcome → Welcome.ini' [Image A]. You can just repeat this process if you want to bring it back.

3 DISPLAYING SKINS

You'll notice the illustro menu item contains options for several other skins: a Google search box, a Recycle Bin and more system monitors. You can make them visible using the process in the previous step. They appear on top of one another in the top-left corner and can be dragged to new positions.

4 INSTALLING NEW SKINS

We're now going to install one of the most popular skin suites, Kaelri's Enigma. Go to http://bit.ly/1iXJGMZ, download Enigma and run the installer. Now right-click any skin and choose 'Rainmeter → Layouts → Enigma Preview' to see the new skins [Image B]. If you have trouble, choose 'Rainmeter → Manage → Refresh all' and retry.


A
17:42
Saturday
03.01.2015
SYSTEM
CPU Usage 5%
RAM Usage 66%
SWAP Usage 40%
C:\
Welcome.ini
Clock
Disk
Google
Network
Recycle Bin
System
Welcome
Illustro\Disk
Variants
illustro
Settings
Manage skin
Edit skin
Refresh skin
Rainmeter
Unload skin

WELCOME TO RAINMETER!

Illustro: Getting started with Rainmeter skinning

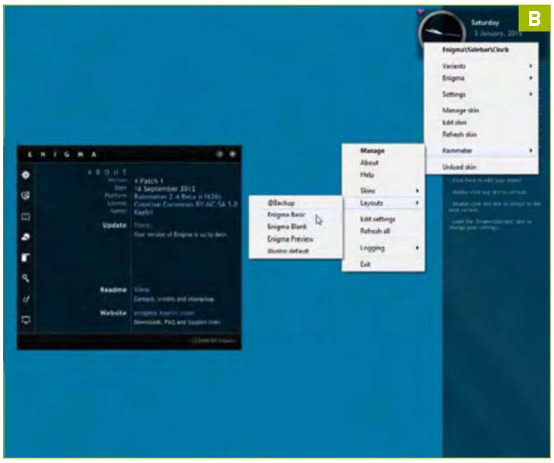
Illustro is a simple set of skins designed to show some of the capabilities of Rainmeter. It offers a good place to start learning how to edit Rainmeter to make it your own. Use the "Rainmeter 101" link on the right to learn the basics.

To explore installed skins and change Rainmeter settings, simply click on the Rainmeter tray icon.

Recommended skin suites: Start using Rainmeter now!

There are literally thousands of skins available for Rainmeter. We have a few popular ones we recommend, which you can install with just a few clicks.

- Recommended Skin Suites
- Rainmeter 101
- Rainmeter Manual
- Rainmeter Forums


B
Saturday
3 January, 2015
Enigma\Sidebar\Clock
Variants
Enigma
Settings
Manage skin
Edit skin
Refresh skin
Rainmeter
Unload skin
E N I G M A
A B O U T
Update
Readme
Website
@Backup
Enigma Basic
Enigma Blank
Enigma Preview
illustro default
Manage
About
Help
Skins
Layouts
Edit settings
Refresh all
Logging
Exit

5 DELVING INTO ENIGMA

You can now work through the icons on the left of the 'Options' dialog to customise any details you want to tweak. Deselect the 'Options' dialog in the Enigma menu when you're finished, along with any skins you don't want to use. Right-click any skin and choose 'Edit skin' if you want to adjust its behaviour.

6 BEYOND ENIGMA

Now we're going to grab some other skins. Head to http://bit.ly/17tj0iX and install 'Arcs', which is a graphical system monitor and clock. It should display automatically. Right-click and choose 'Arcs → Legend' to see a diagram explaining what it all means. You can also opt for 'Darks Arcs' if you prefer that colour scheme.

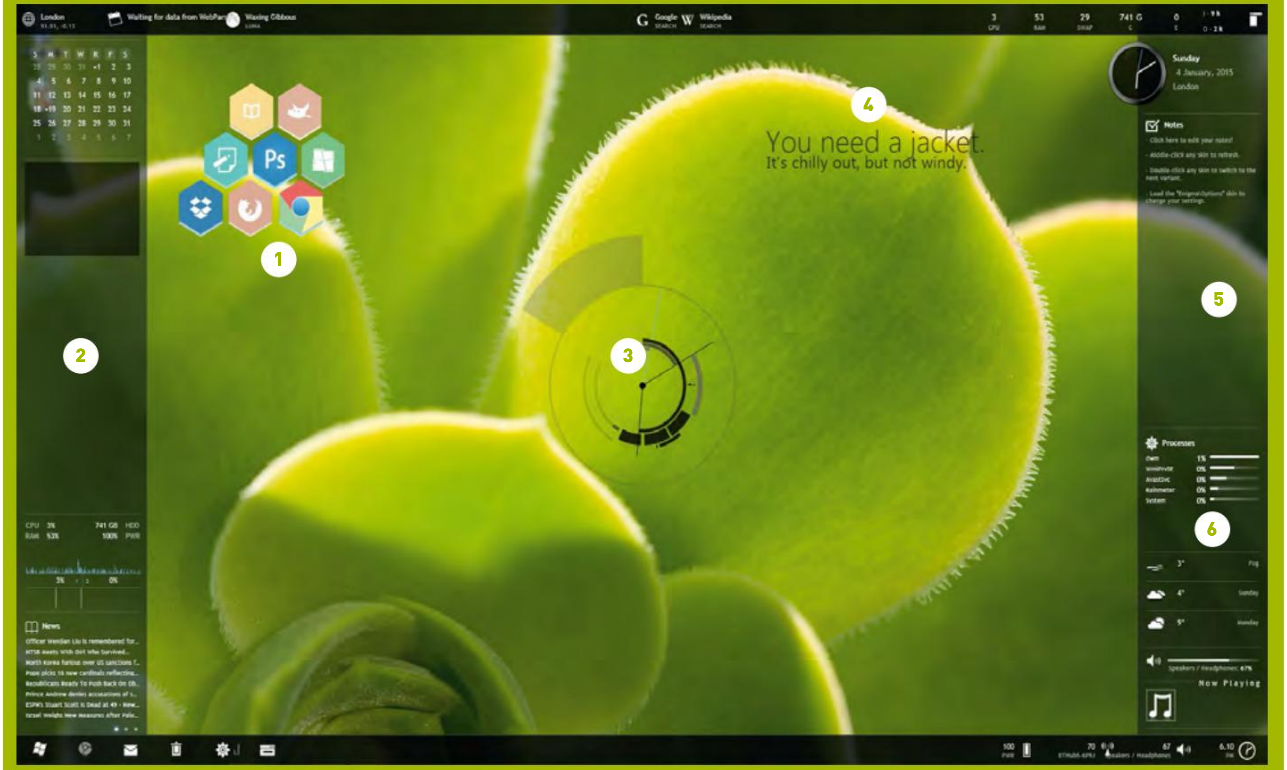
7 WINDOWS TWEAKS

We reckon the Windows Taskbar is cramping our style a bit, so right click it and select 'Properties → Auto-hide the taskbar'. You may have to restart Windows before the Enigma Taskbar moves down. Also head to Control Panel and select a more interesting background to go with your sleek new desktop [Image C].

8 SKIN HUNTING

One of the best places to find more skins is rainmeterhub.com [Image D], as well as on rainmeter.net/discover. Do your research when installing skins, as sometimes people hide malicious programs inside them. It's also a good idea to install an ad blocker, otherwise you'll see a lot of confusing download links.

GIVE ME SOME SKIN


1
2
3
4
5
6
You need a jacket.
It's chilly out, but not windy.

1. HONEYCOMB
The Honeycomb skin provides icons for a library of applications that can be arranged into a honeycomb. Go to rainmeterhub.com/skins/honeycomb.

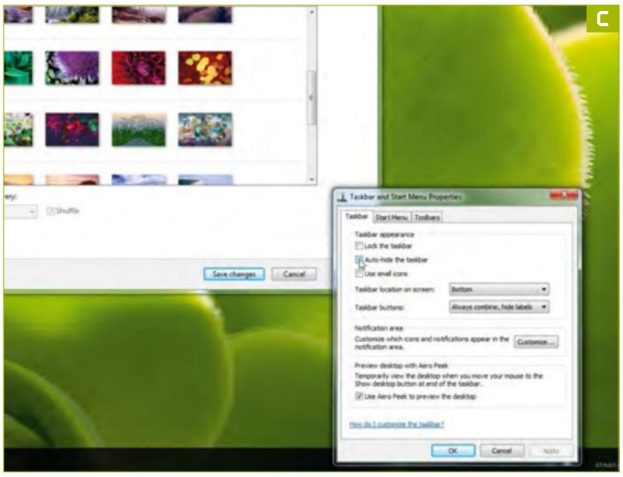
2. THE ENIGMA SUITE
Everything you see around the edge of this desktop is from the Enigma suite, which is a collection of skins designed to work together.

3. ARCS
This stylish collection of arcs and circles houses a clock and system monitor that matches the Enigma suite.

4. YOU NEED A JACKET
For when looking out the window is simply far too much hassle. Get friendly clothing recommendations from your desktop with this skin that offers advice based on information from Yahoo weather.

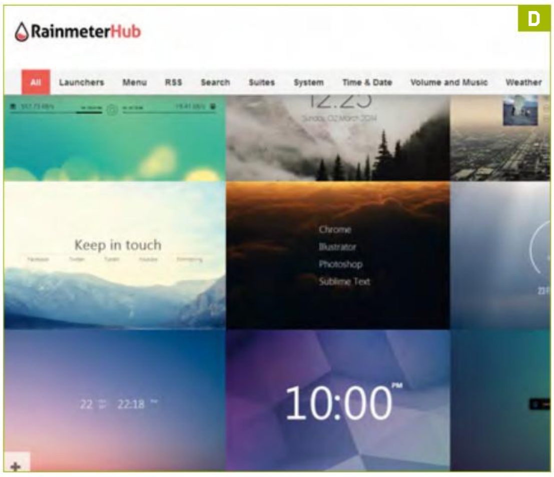
5. EDITING SKINS
Right-click a skin and choose 'Manage Skin' to bring up an options dialog. From here you can edit settings and 'Unload' items you don't want.

6. PROCESSES
This handy and discreet skin displays currently active processes, so you can see at a glance what's eating up your PC's system resources.



9 MIX AND MATCH

Next we're going to add a weather skin that recommends what you should wear before venturing outside. Get it from rainmeterhub.com/skins/need-jacket/. Hover over the skin and click the cog to open its settings file, where you can change the font and the thresholds for its jacket advice. The question mark icon gives you instructions for entering your location.


D
RainmeterHub
All
Launchers
Menu
RSS
Search
Suites
System
Time & Date
Volume and Music
Weather
Keep in touch
Chrome
Illustrator
Photoshop
Sublime Text
10:00

10 SAVING LAYOUTS

Once everything's as you want it, you should save your setup as a layout. Right-click a skin and choose 'Rainmeter → Manage' and go to the 'Layouts' tab. Enter a name and click 'Save', checking the wallpaper box if you like. Now your layout will appear in the 'Rainmeter → Layouts' menu so you can always go back to it. ■

ASK LUIS

BY LUIS VILLAZON

All The Stuff You Didn't Know About

Dishing out free technical advice, before the new financial year

RAINBOW CHASING

THE MOON ON A STICK, PRETTY PLEASE

I'm happily still getting good gaming performance out of my old rig (QX6850 quad core o/c'd to 3,300GHz, 8GB RAM, GTX460, Win7). I recognise the time is nigh for a new one but being married with three daughters, I can no longer justify a direct replacement, so I'm considering building a living room PC and keeping the old rig.

The new one should play music, photos, movies, Amazon Instant, Freeview and Sky, plus access, play, transfer and stream to other Windows and iOS devices. I want recording and pausing for all the above, a channel guide, web browser, DVD burner, NAS server, Steam and home access for the printer/scanner. What is the lowest power CPU and GPU combo that can power this and what OS and apps do I need? It's got to be (non-techie) family-friendly otherwise it won't get used.

Giles

Should it also take 10 years off your age in the mirror, and earn £££ for you while you sleep? What you want does not exist. Just getting all that functionality in a single box would be extremely challenging. Controlling it all with a single software interface is nearly impossible and demanding that it also be simple enough for the rest of your family frankly elevates your request to the realms of the mythical. More importantly, the PC isn't really the right tool for this job.

You've just got yourself locked into the idea of building a single computer that is all things to all men (and women). That's what we used to do in 2005. A combination of Sky+ and a PS4 or Xbox One will handle most of the TV and streaming duties and will be cheaper and easier for everyone to use. That frees up some cash to funnel into the real business of the day, which is upgrading your PC (or at least the motherboard and CPU) for gaming. And if you really need a NAS and print server, get a dedicated device like the £40 D-Link ShareCentre Pulse. This will stream simultaneously to the console and the PC, and share your printer too. Just add whatever size drives you want.

It ain't 2005 anymore – a console box will happily look after your TV streaming.

REPRODUCIBLE CALAMITY

I SHOULDN'T NEED PERMISSION!

Is there a way to get rid of those messages that tell me I need to provide administrator permission every time I copy files and folders from a USB stick? I'm sure this didn't used to happen, but ever since I upgraded to Win8.1, my PC never seems to stop nagging me!

Peter Biggs

This is part of User Account Control, or UAC, which is designed to stop malware from writing or deleting files without your explicit say-so. You can turn off UAC by editing the 'HKLM\SOFTWARE\

FREE TECHNICAL SUPPORT

Email Luis for guaranteed insults and possibly even some technical help as well.

pcfhelpline@futurenet.com
PCF Helpline, Quay House,
The Ambury, Bath BA1 1UA

The six categories of all human misery

REPRODUCIBLE CALAMITY
Things that break predictably.

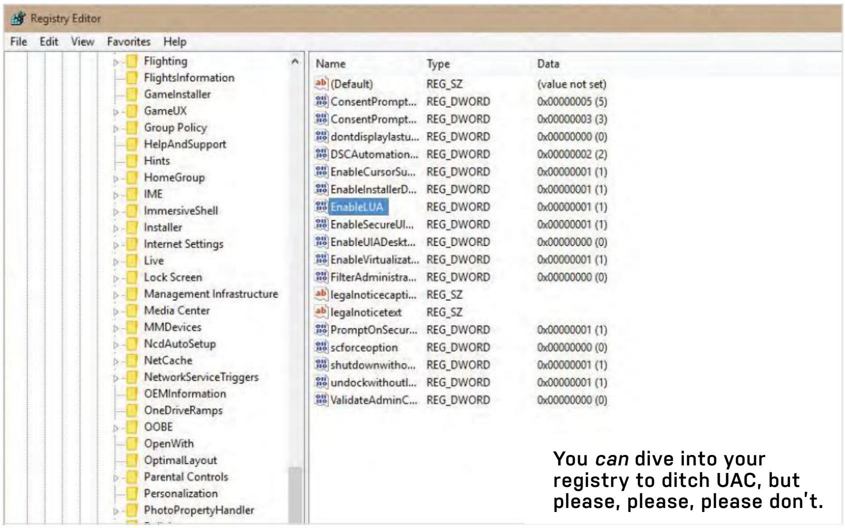
RANDOM WEIRDNESS
Things that break unpredictably.

CREEPING BADNESS
Things that just get worse.

OMINOUS PORTENTS
Things that might be a problem.

SPONTANEOUS BREAKAGE
Things that definitely are.

RAINBOW CHASING
Things that could be so much better.



Name	Type	Data
(Default)	REG_SZ	(value not set)
ConsentPrompt...	REG_DWORD	0x00000005 (5)
ConsentPrompt...	REG_DWORD	0x00000003 (3)
dontdisplaylastu...	REG_DWORD	0x00000000 (0)
DSCAutomation...	REG_DWORD	0x00000002 (2)
EnableCursorSu...	REG_DWORD	0x00000001 (1)
EnableInstallerD...	REG_DWORD	0x00000001 (1)
EnableLUA	REG_DWORD	0x00000001 (1)
EnableSecureUI...	REG_DWORD	0x00000001 (1)
EnableUIADeskt...	REG_DWORD	0x00000000 (0)
EnableVirtualizat...	REG_DWORD	0x00000001 (1)
FilterAdministra...	REG_DWORD	0x00000000 (0)
legalnoticecapti...	REG_SZ	
legalnoticetext	REG_SZ	
PromptOnSecur...	REG_DWORD	0x00000001 (1)
scforceoption	REG_DWORD	0x00000000 (0)
shutdownwitho...	REG_DWORD	0x00000001 (1)
undockwithoutl...	REG_DWORD	0x00000001 (1)
ValidateAdminC...	REG_DWORD	0x00000000 (0)

You *can* dive into your registry to ditch UAC, but please, please, please don't.

Microsoft\Windows\CurrentVersion\Policies\System' key in the registry and changing EnableLUA to '0'. But don't do this. Running Windows without UAC is like taking the battery out of your smoke alarm. You tell yourself you'll put it back after you have finished making toast. And then four weeks later the house burns down in the middle of the night. And you with it. A better option is to make your user account the owner of the destination folder. That is normally enough to quieten UAC messages for that specific folder, but it still leaves UAC protecting you for everything else. See this month's step-by-step guide for a more detailed explanation of how to do this.

It's also worth noting that overzealous antivirus programs can trigger more of these warnings than usual. Avast! File System Shield does this, for example. You can turn off the File Shield without disabling everything else by clicking 'Settings → Active Protection → File System Shield → Off'.

> "FOUR WEEKS LATER THE HOUSE BURNS DOWN IN THE NIGHT. AND YOU WITH IT."

OMINOUS PORTENTS

THE PLOT OF TAKEN 4

I recently had an email advising me that one of my online passwords had been changed, even though I hadn't changed it myself! When I tried to log in, it no longer accepted my password and I had to spend a long time exchanging phone calls and emails with customer services to get my account reset. The website in question was unable to tell me how this happened, and seemed to think it was someone in my family, which it wasn't. Do you have any ideas about how hackers could have done this? How can I protect myself?

Anders Blumgardener

They probably just guessed the answer to your secret question. The other easy way to hack someone is to trick them into installing a keylogger on their PC. A keylogger is a little program that invisibly records every keystroke you make on your keyboard and then sends it to a hacker, who looks through this file for a likely looking password, typed just after you entered "www.amazon.co.uk", for example. But if you'd been hacked with a keylogger, you'd probably have seen a lot more than just one lone website hacked. And installing a keylogger requires physical access to your PC, or tricking you into downloading and executing a trojan.

Guessing most people's secret question on the other hand is usually very easy. Your mother's maiden name is a matter of public record, for example, and things like your pet's name or your favourite movie can often be guessed by snooping through your Facebook page. Hackers can easily look at public profiles, which often shows the school people went to, and create a fake profile posing as someone from that school. Then they make a friend request from that profile, which many people will accept out of curiosity.

The solution is to treat the 'answer' to your secret question as just another password. What is your mother's maiden name? Why, it's octogon294 br@vura of course. Write that down somewhere safe and you have a secure way to recover your password. Secret questions aren't used much anymore, precisely because they aren't very secure. Most of the big sites will only send password reset links to email addresses that have previously been associated with your account.

YOU ASKED!

FAQ

BootChess

Is this a new supercomputer chess program?

Quite the reverse. It's a full chess program, implemented in just 487 bytes of memory. Not megabytes, *bytes*!

Is that a world record?

It is. In fact it beats a record that has stood for 32 years, since 1K ZX Chess was written in 1983 by David Horne for the ZX-81.

Is this really playable chess, with a board and everything?

Yes, although the board is represented just as a grid of ASCII characters, with uppercase letters for the white pieces and lowercase for black. The empty squares are just full stops – you have to keep track of which ones are black and white yourself. The program also skips some of the subtler rules of normal chess, such as castling.

And does it have a computer AI to play against?

Yes, but it isn't going to beat Gary Kasparov. The algorithm doesn't look ahead more than one move and just tries to capture as many pieces as it can, and close in on the opponent's king.

What is it written in?

Assembler, which is one step up from binary machine code and just consists of a series of very simple instructions that move data from one CPU register to another. You can compile the source code for Windows, Linux, OS X or DOS and it is designed to be written directly to the boot sector of a floppy disk. You then boot your computer from the disk and it loads directly to the BootChess program.

Couldn't you just use a source code compression program to make BootChess even smaller?

No. BootChess is so tightly optimised that programs such as aPACK actually make the program bigger!

Read more at:

http://lpaste.net/119343

OMINOUS PORTENTS

THE NEXT BIG THREAT?

I often see advice on hardware forums advising me to download this or that firmware update to upgrade a device to the latest version. From what I understand, firmware is just a special kind of executable that runs inside my drive controller or graphics card or whatever. So what is to stop this executable from becoming infected by a virus? If my hardware gets infected, will my antivirus program detect it?

Bryn Clewes

There's nothing in principle that prevents firmware from being infected with malware. Firmware is executable code that is run by the embedded processor on a device. If you change the instructions in that firmware, you could make the hardware do something it wasn't meant to. But a virus is a specialised kind of malware that spreads itself from one PC to the next and that's only possible from certain hardware devices. Your graphics card only has hardware to allow it to write to video memory; it can't infect another PC because it has no access to the network card or disk drives. Theoretically the firmware in a network card or a drive controller could do this but it would be technically very difficult to do.

In the 1990s we had file viruses that were capable of encrypting your BIOS. That's a kind of firmware virus, I suppose, but the virus didn't live in the BIOS firmware itself – it just used the BIOS as a sort of digital hostage.

So it might happen one day, but at the moment I don't know of any virus or worm that resides within the firmware of a hardware device. However, most firmware is installed by downloading an installer executable and that installer *absolutely* can be infected. As a matter of protocol, I disagree with installing firmware updates speculatively. But if you do, only download from the original manufacturer's website. If you have any doubts, upload the file to virustotal.com first and get it scanned.

"I FORBID IT. YOU'RE STILL RUNNING WINDOWS XP AND THIS SIMPLY WILL NOT DO."

SPONTANEOUS BREAKAGE

I'M DEAF!

My faithful PC has suddenly lost all sound. I've checked the speakers and they're definitely fine. In Control Panel it says "No Audio Device", but when I look in Device Manager, it lists 'Audio Codecs', 'Legacy Audio Drivers' and 'MPU-401 Compatible MIDI Device', so there's obviously something there! I'm running XP, by the way.

Stav Ioannou

It's equally obvious there's something missing. None of those things are the driver for your soundcard, which should be listed, even if you're using integrated sound on your motherboard. In Device Manager you can click 'Action → Scan for Hardware Changes' to force it to redetect your hardware. You *can* do this, but you may not. I forbid it. You're still running Windows XP and this simply will not do. I'm quite happy for you to put off fixing things if they ain't broke, but once they're broke you have to fix them properly. In your case that means upgrading to Win7 at the very least. But it may also be that your sound has gone because the sound controller has failed, in which case you should brace yourself for replacing the motherboard as well.

RAINBOW CHASING

ESCAPE THE PLANET

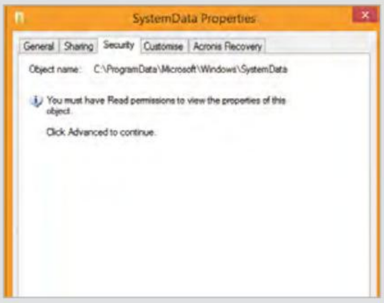
I know you're quite the *KSP* expert, so I humbly turn to you for help in matters rocketry. I'm trying to build a ship that can land on Eve and return in a stock game on hard difficulty. I've some designs that look promising but I would like to test them. Is there a way to simulate an Eve landing and takeoff? I stress that this is in a completely unmodded game. I want the most hardcore experience.

Sian Lloyd

We all have our own ideas of what counts as 'cheating', and *KSP* in particular is a game where each of us can tweak the game with mods to make

Own Your Files

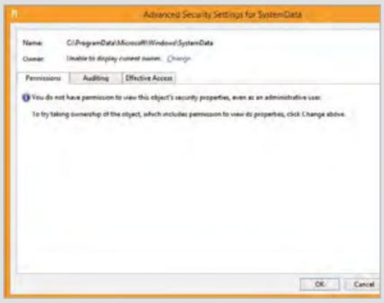
Possession is nine-tenths of the law...


SystemData Properties
General
Sharing
Security
Customise
Acronis Recovery

Object name: C:\ProgramData\Microsoft\Windows\SystemData

You must have Read permissions to view the properties of this object.

Click Advanced to continue.


Advanced Security Settings for SystemData
Permissions
Auditing
Effective Access
OK
Cancel

Name: C:\ProgramData\Microsoft\Windows\SystemData

Owner: Unable to display current owner. Change

You do not have permission to view this object's security properties, even as an administrative user.

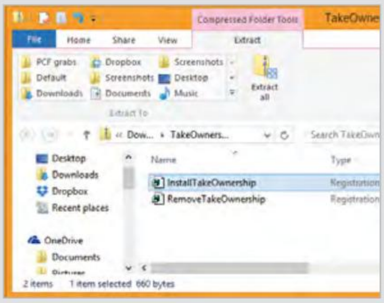
To try taking ownership of the object, which includes permission to view its properties, click Change above.

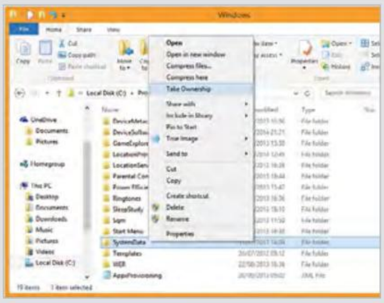
1 The problem

Being the administrator user in Windows doesn't give you permission to make modifications to absolutely any file. For some system files, and files created on external media by other users, you can still find yourself locked out. That's because you're not the owner of these files.

2 The hard way

In Windows 8, admin users can take ownership of a file or folder by right-clicking and choosing 'Properties'. Then, on the 'Security' tab, click 'Advanced'. Where it says "Unable to display current owner", click 'Change'. Enter your Windows login name and click 'OK'.


Compressed Folder Tools
TakeOwne
File
Home
Share
View
Extract
PCF grabs
Dropbox
Screenshots
Default
Screenshots
Desktop
Downloads
Documents
Music
Extract all
Extract To
TakeOwners...
Search TakeOwn
Desktop
Downloads
Dropbox
Recent places
OneDrive
Documents
Name
Type
InstallTakeOwnership
RemoveTakeOwnership
Registration
Registration
2 items 1 item selected 660 bytes


Windows
Open
Open in new window
Take Ownership
Pin to Start
Send to
Cut
Copy
Create shortcut
Delete
Rename
Properties
Local Disk (C:)
OneDrive
This PC
Desktop
Documents
Downloads
Music
Pictures
Videos
SystemData
Templates
AppReadiness

3 The easy way

That's quite a lot of flap to be going through every time you want to be taking ownership of one object, so if you find yourself doing it a lot, you'll want a shortcut. You can download a set of registry hacks to add this to the context menu by heading to http://bit.ly/1Jmjw2L.

4 The result

You finally need to double-click 'InstallTakeOwnership.reg' (or open it in Notepad first, to check the registry keys it will modify). To take ownership of any file, you can just right-click and choose 'Take Ownership'. You'll normally still need admin rights to do this though.

However careful you are with the calculations, this is how it will end.

it as easy or hard as we like. Personally, I regard playing pure stock as slightly *too* cheaty, because the default game doesn't (as of v0.90) model re-entry heating, and lets you aerobrake into atmospheres at 8km/s with no ill effects. Conversely, I have no problem with installing Kerbal Engineer Redux (KER) to tell me the delta-V of each stage in my rockets. (For those that don't play *KSP*, delta-V is a way of measuring the 'oomph' in a rocket.)

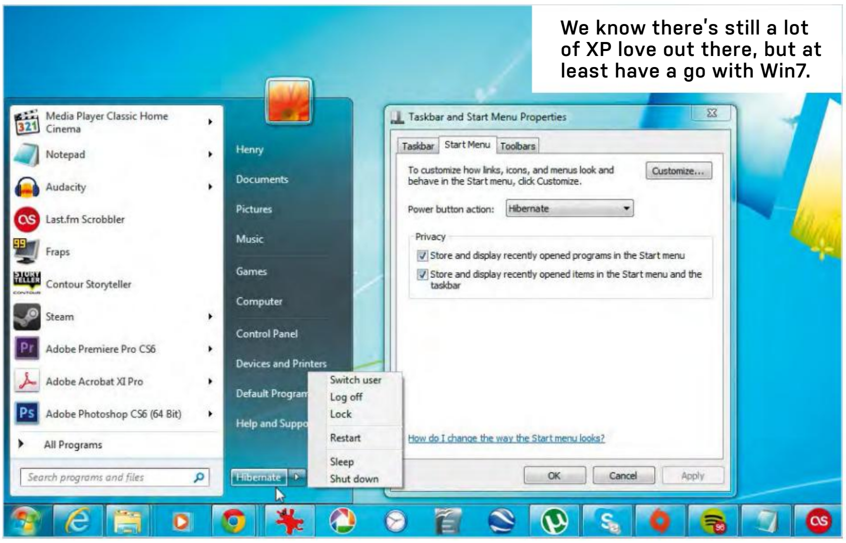
Landing on Eve is essentially free because, apart from a tiny deorbit burn, you can rely on aerobraking and parachutes to touch down safely. But taking off again will cost you about 11.5km/s of delta-V. If you don't want to use KER to calculate how much you have, you can use the online tool at strout.net/info/science/delta-v/. You can even do it yourself if you want to. The equation you need is called the Tsiolkovsky rocket equation: delta-V = ISP of your engine x 9.81 x the natural logarithm of mass-of-rocket-plus-fuel ÷ mass-of-rocket-empty. Working that out every time you change your rocket design ought to be hard enough for you.

But suppose you don't want to use mods or online calculators *or* do the sums yourself? Is there a way to simulate an Eve takeoff? Well maybe. The delta-V to reach orbit on Kerbin is about 4.5km/s, so if your ship can launch to orbit, land, launch to orbit again, land again and then reach the edge of space for a third time, *without refuelling*, it's a good indication you're ready for Eve. But Eve's surface gravity is about double Kerbin's so you need to be able to do that at half-throttle as well.

CREEPING BADNESS
OFF THE WAGON

I'm considering getting back into *World of Warcraft*. I last played it during *Cataclysm*. If I start now, will I have to buy all the expansions since then? What about my old characters? Will they still be there or will I have to level again from one? Is this a bad idea?
Aidan Lewis

"All the expansions" since *Cataclysm* is just two expansions: *Mists of Pandaria* and *Warlords of Draenor*. You don't need to buy *Mists* because all the expansions up to and including *Mists* are now included in the base game. Even a new player who's never installed the game before would only need to pay £9.99 to download the base client, giving game content up to level 90. Blizzard already makes plenty of money from the £9.99 per month subscription fee, so it doesn't



We know there's still a lot of XP love out there, but at least have a go with Win7.

Media Player Classic Home Cinema
Notepad
Audacity
Last.fm Scrobbler
Fraps
Contour Storyteller
Steam
Adobe Premiere Pro CS6
Adobe Acrobat XI Pro
Adobe Photoshop CS6 (64 Bit)
All Programs
Search programs and files
Henry
Documents
Pictures
Music
Games
Computer
Control Panel
Devices and Printers
Default Programs
Help and Support
Hibernate
Switch user
Log off
Lock
Restart
Sleep
Shut down

Taskbar and Start Menu Properties

Taskbar
Start Menu
Toolbars

To customize how links, icons, and menus look and behave in the Start menu, click Customize.

Customize...

Power button action: Hibernate

Privacy

☑ Store and display recently opened programs in the Start menu

☑ Store and display recently opened items in the Start menu and the taskbar

How do I change the way the Start menu looks?

OK
Cancel
Apply

FLASHBACK

What Luis Said...

SILKY SMOOTH MOVIES
HACK YOUR CODECS INTO SUPER SHAPE
FREE DVD
GAMES 'N' TOOLS
PERFORMANCE GEAR & GAMING
PCFormat
GAMEGASM!
DESKTOP DESTROYER
New Core i7 Alienware lappie hits 69fps in our supertest!
PLUS! Five more hi-spec speedsters rated
NO.1 FOR GEAR
Nvidia Fermi
The latest on Nvidia's DX11 card
"I'VE DONE NOTHING, AND NOW I'M DEAD"
Henry finds AvP somewhat frustrating
HOTWIRED!
GET MORE FROM YOUR RIG
BOOST YOUR WIFI RANGE
OPTIMISE YOUR SSD WITH TRIM
TWEAK MASS EFFECT 2
THERE'S MORE...
The scariest games ever made
Get more from Runes of Magic
Hardware media player roundup
MORE THAN A TANK RUSH
STAND ASIDE MW2
techradar.com
Future

5 years ago *(PCF238)*

About the best game ever

Mass Effect is not the best game ever. You may be confident it's the best game *so far* but to go further would be dangerously hubristic. Wait 20 years until you've played *Mass Effect XVI* on a nanobot, 12D, quantum computer injected directly into every cell in your body. Then wait another 20 and check out *Mass Effect MML*, played as a stream of high energy gluons fired through your butt-cheek. *Then*, as we sit amid the rubble of civilisation, we can discuss the best game ever. Not before.

10 years ago *(PCF172)*

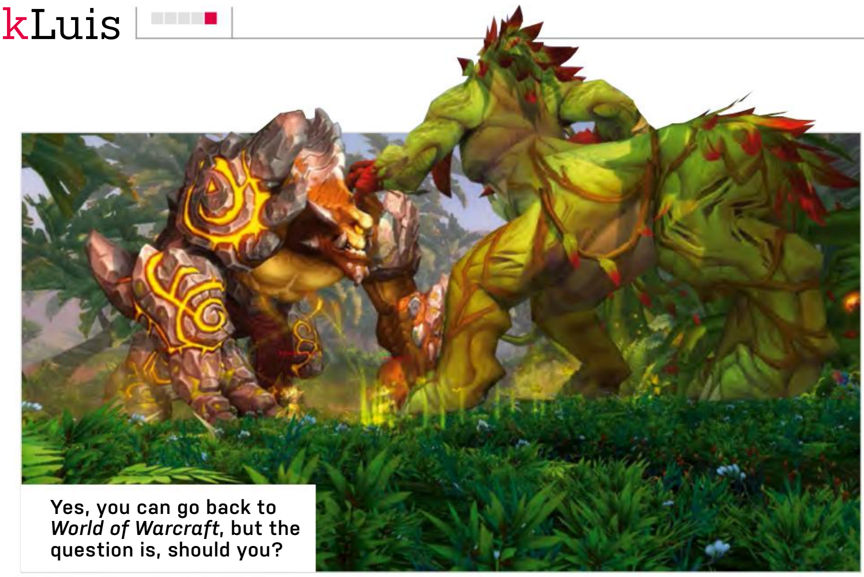
About copying hard disks

Serial-port networking is *the* most effective way to annihilate a Saturday. It ought to work, it looks like it *is* working. But then, it doesn't. Four hours later, you'll wonder if maybe you should've just moved the hard disk into the newer PC. Take a tip from that older, sadder but infinitely wiser, future-you and do it now.

15 years ago *(PCF107)*

About monitors

CRT stands for Cathode Ray Tube, as any fule kno. This is not a feature, any more than "Look! Now with mains power!" is. *All* monitors are CRT unless they're flat-panel LCD displays of the kind used in laptops. FST is Flatter Squarer Tube and this is something to look for, but note the telltale "-er" suffix. All CRTs are curved to some extent, but the less the better.



Yes, you can go back to *World of Warcraft*, but the question is, should you?

want to put you off. You'll only need the *Warlords of Draenor* expansion if you want to level past 90 or use the Garrisons feature.

Your old characters should still all be on your account too. I don't think Blizzard ever deletes your account completely. Even if your old server has been closed or merged, it should be possible to resurrect things. But it's laughably easy to power through the early levels now and if you buy *Warlords of Draenor*, you get a free boost to take one character to level 90 anyway.

Your last question is the hardest. I'm a recovering WOWaholic (clean four years and counting), which undoubtedly colours my opinion. I'd advise anyone who's never played before to at least give the free trial a go. But if you've already played it to death, I don't think you're going to recapture those past glories with the new one.

RAINBOW CHASING
SOURCE CODE SHAME

I'm a postgraduate biologist working on population modelling in black squirrels at a university I'd rather not name, for reasons that will become obvious. As part of my research, I've written some programs in various different languages that some of my colleagues have expressed interest in. I've always stalled them when they ask for my source code because the truth is I'm very embarrassed by it. It's very clunky and kludgy with no comments and definitely no documentation. I don't have the time to rewrite it all properly, but I can't let them see it like it is. Are there simple tricks or automated tools that will tidy up my code, and maybe make it easier to add comments?
Mark Devries

I'll let you into a secret – anyone that writes programs by themselves writes kludgy code that is really hard for anyone else to read. That includes hobby programmers, lone game developers and academic programmers. The only people that write elegant, legible code are the ones that know it will be paraded in front of their peers, at the regular Tuesday morning code review session.

If your code works, there's no reason you should feel embarrassed by it. If it doesn't, then all the more reason that colleagues should have a chance to spot the flaws, before you base your PhD on the results it generates. So don't waste time refactoring your code. You'll just introduce new bugs. Instead, release it using the Community Research and Academic Programming (CRAP) license (matt.might.net/articles/crapl/). The terms of this license explicitly indemnify you against "shame, embarrassment or ridicule for any hacks, kludges or leaps of faith found within the Program".

SPONTANEOUS BREAKAGE
NOTHING WORKS!

I can't get Windows to start. All that happens is a page with strange characters on the left-hand side. Holding [F8] when I start does nothing, as does the recovery disk. Help!
Michael McGill

The beauty of really nasty faults is that they're easy to diagnose. If you can't even reach the BIOS setup page then this is nothing to do with your drivers, or Windows, or your hard disk. It's a mobo fault; possibly a corrupted BIOS, possibly a broken line on one of the buses – it doesn't matter really. Proceed directly to Amazon and buy a new one. Do not pass go and do not collect £200.

RANDOM WEIRDNESS
SUDO SURPRISE

I tried to add my Linux login to the 'video' group with the command 'sudo usermod -G video $USER'. This seemed to work without errors but didn't really give me membership of the group and when I tried to repeat the command to make sure I'd done it right, it gave me the error, "Sorry, user franklin is not allowed to execute '/usr/bin/usermod -G video $USER' as root". It's the same command as before! What changed?
Frank Carries

What changed was that you removed yourself from the sudo group by accident. If you use the '-G' switch by itself, usermod will remove you from all groups except the ones you specify. What you actually meant to say was 'sudo usermod -a -G video $USER'.

The '-a' switch modifies the behaviour of '-G', so that it appends the listed group membership, rather than deleting all the others. Of course it's too late to add that switch now, because you aren't in the sudo group, so you can't use the sudo command. You can still use su to become root though. Once you've entered the root password, you can just use 'usermod -a -G sudo franklin'.

If your Linux install includes it, 'adduser' is a safer way of adding group membership – 'adduser franklin sudo' doesn't rely on you remembering the switches to distinguish between adding and replacing. ■

STATS KNOW-IT-ALL?
Quiz

1. What is the Dark Internet?
a) Websites not indexed by search engines
b) Websites that have been abandoned
c) Websites not reachable by external routers
d) Deliberately secret websites

2. What proportion of The Onion Router (Tor) traffic goes to Dark Internet sites?
a) 80%
b) 55%
c) 18%
d) 1.5%

3. What exactly is a Tor hidden service?
a) Anyone using The Onion Network to make their browsing anonymous
b) A website that uses Tor to hide its physical location
c) Malware installed by hackers on Tor users' PCs
d) The small print on Tor's end-user agreement

4. What proportion of Tor traffic is alleged to be child pornography?
a) 80%
b) 55%
c) 18%
d) 1.5%

5. Which of these is *not* a Tor hidden service?
a) TorSearch
b) The Pirate Bay
c) Silk Road
d) Facebook

Answers: 1a, c or d 2d 3b 4a 5 They all are

NEXT ISSUE

Build your PERFECT GAMING PC

WHATEVER YOUR BUDGET, WE SHOW YOU HOW TO BUILD THE BEST MACHINE FOR MODERN PC GAMING

PLUS

- Graphics card supertest – get the right graphics card for your rig
- Give Linux a chance – we show you how

PCFormat PERFORMANCE GEAR & GAMING

ISSUE 304 ON SALE
9 April 2015

Month in numbers...

3.5GB

The actual memory available for games running on Nvidia's GTX 970 GPU. Despite shipping with 4GB of RAM, it's been designed to only access 3.5GB. Gamers attempting to access the final 512MB have encountered performance problems and seven years bad luck.

110,000

The number of Facebook users affected by a Trojan horse which invites people to click on a supposed porn video, before forwarding itself onto their friends. This is why our only source for porn is abandoned magazines near railway tracks.

12%

The year-on-year fall in overall tablet sales in 2014, according to tech industry analyst Canalys. Large-screen tablets, however – such as Microsoft's 12-inch Surface Pro 3 – are still expected to entice the device-laden public and sell well in the coming 12 months.

$29.3 billion

Amazon's net sales in the fourth quarter of 2014 – a record for the company. We had no idea selling nets could be so lucrative, but apparently customers taking out Prime subscriptions had something to do with it too.

1Gbps

The internet speed BT hopes to roll out to its customers by 2020. The telecoms company will trial the blazing-fast broadband in Huntingdon in Cambridgeshire and Gosforth in Newcastle, in case you want to move house to get faster downloads.

ILLUSTRATION: KEVIN FEBRUARY

THE VOICE OF REASON

Pleasing the Crowds

***PC Format* has a mole. A man wedged inside the games industry's nether regions. A man rendered so hideously paranoid by a life spent playing sub-standard PS2 ports that he won't even let us edit his copy. These are his troubled thoughts...**

WHAT COMES AFTER HIPSTER? I'm not sure, but one sat next to me on the bus the other day. He had half a fake moustache glued to the side of his nose, a t-shirt with his own head Photoshopped onto Nigel Farage's body, and a pair of tie-dye moccasins crafted by a highly trained Tibetan yak.

I was using an emulator on my phone to play *Grim Fandango* in its original form. The nostalgic areas of my body were pleasantly tickled by the fact I could play a 17-year-old game on a piece of hardware I could put in my pocket, and it's a great example of a game which uses the restrictions of technology to its favour.

"Catface catface snowflake fire engine," said the on-trend young man, who used emojis alongside regular diction. "What you playing grandad?"

"This is a classic of the point-and-click adventure," I explained. "Every game you play nowadays owes something to the exemplary world Tim Schafer built with *Grim Fandango*."

"Yeah, but your game looks well orange tractor," replied the boy. "You want to get some more pixels in there mate. And some sub-surface scattering, anisotropic aliasing and depth-of-field rendering. I'd up it to an HD resolution and increase the frame rate. Then it'll look werewolf."

The boy made me think. Fortunately, the remastered edition of *Grim Fandango* had been released on exactly the same day. I immediately installed it on my laptop. The following day I sat next to the young man and fired it up, hoping to impress him. "Ear rice bowl 24-hour garage," he said. "That looks more left-facing arrow. But what's with the game? The pacing is slow, there are no XP systems, no gamification of in-game systems, no sub-quests and no physics engine. It's so telescope."

Thus began an epic quest to make this game into something the boy would like, for fear of him thinking I'm some kind of fuddy-duddy. I contacted Tim Schafer, who reassembled the entire team who'd made *Grim Fandango*, and turned it into something more suited to modern gamers. Manny Calavera now carries a range of high-powered weaponry, it's set in a post-apocalyptic world, and the whole thing has been ported to the Unreal Engine 4.

The next day I pulled my entire gaming rig – on a wheeled desk – onto the bus, and the young gent sat next to me once again. "That's better – it's so aubergine!" he said. "But there's no drop-in co-op is there? The game is still total Dreamcast logo." At this point I gave up.

The next day I returned to the bus and played *Grim Fandango* in its original form on my smartphone. I realised the endless pursuit of making things better in the hope of capturing a new audience dilutes and undoes everything that made the games great in the first place. Meanwhile my new friend sat next to me with a game on his iPhone. "So what exactly are *you* playing?"

"It's called *Indigo Prophecy Remastered*," he said. "It's proper pufferfish handbag." ■

↘ Next issue on sale: 09 April 2015

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